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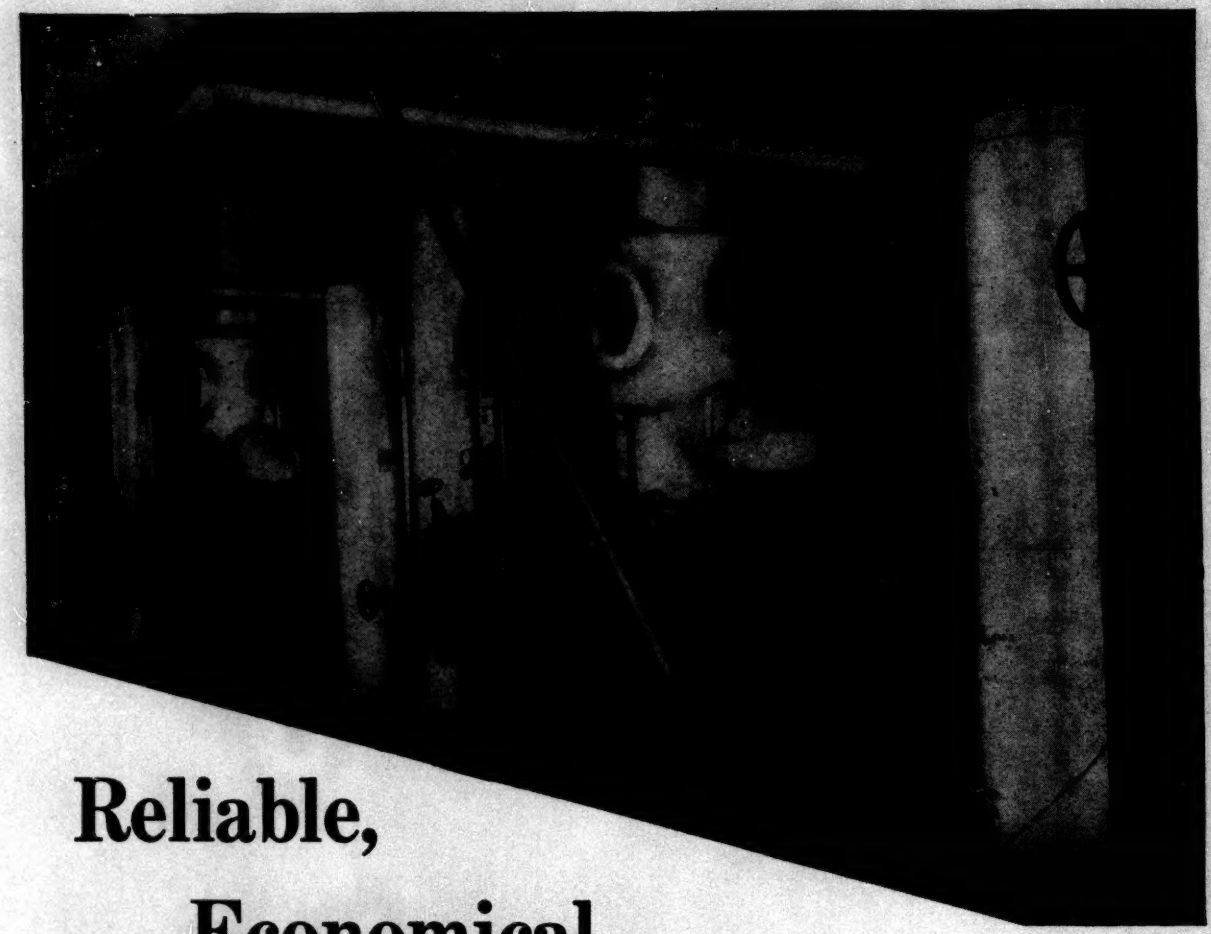
NUMBER 5

NOVEMBER, 1957



Reliable, Economical...

lubricated with Texaco Capella Oil Waxfree

Reliable operation is a must; maintenance costs must be kept down. You'll find *Texaco Capella Oil Waxfree* keeps refrigeration compressors running more smoothly, longer and at top efficiency.

Texaco Capella Oil Waxfree doesn't wax out in systems, even when the temperature drops as low as minus 100 degrees F. Its haze and floc temperatures are exceptionally low. Outstanding for its stability, *Texaco Capella Oil Waxfree* also is designed for high resistance to oxidation. In addition, it does not foam and it is compatible with all refrigerants.

There is a complete line of *Texaco Capella Oils Waxfree* to meet the specifications of all leading compressor manufacturers. It is available in 55-gallon and 5-gallon drums, 1-gallon cans; and the more popular grades can be bought in 1-quart containers. All are refinery sealed to protect the Texaco quality and purity.

Your Texaco Lubrication Engineer can help you select the proper lubricant for your system. Just 'phone the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, New York.

VISIT TEXACO — BOOTH 203 — AIR CONDITIONING-REFRIGERATION SHOW — CHICAGO, NOV. 18-21.

TEXACO

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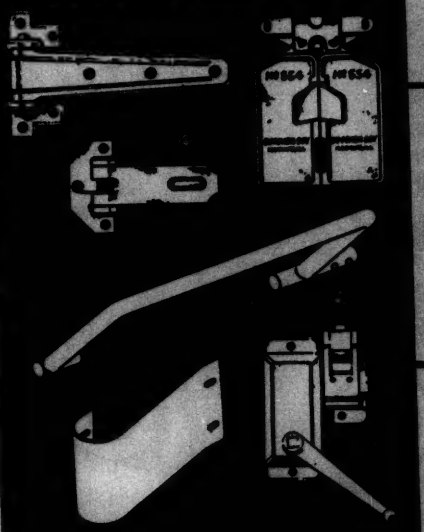
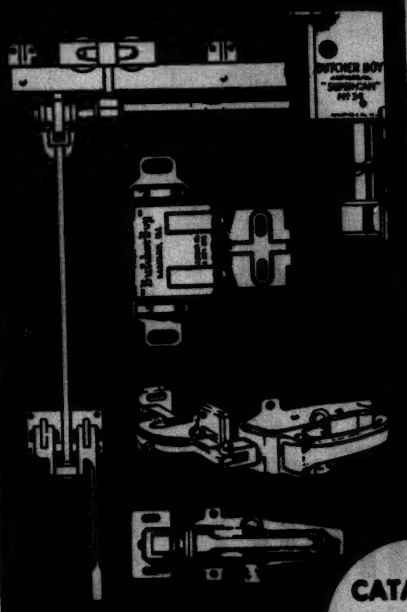
FOR ALL REFRIGERATING AND AIR CONDITIONING COMPRESSORS

"Butcher Boy"
Since 1885

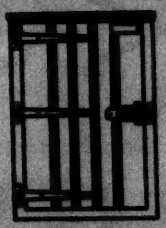
REFRIGERATOR DOOR
HARDWARE





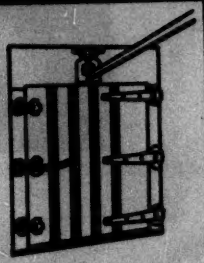
SAFETY RELEASE FASTENERS

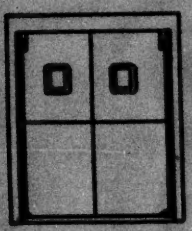
CATALOGS AVAILABLE UPON REQUEST



STANDARD COOLER-FREEZER DOORS

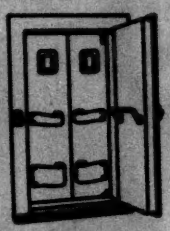
- Modern Streamlined Appearance
- 100% Douglas Fir Construction
- Massive and Durable Hardware





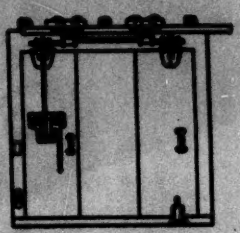
STANDARD VESTIBULE AND AUTO CLOSE DOORS

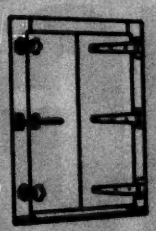
- Double Acting Doors for Loading Docks
- For Heavy Trucking Openings
- Save Refrigeration Losses



HORIZONTAL SLIDING DOORS

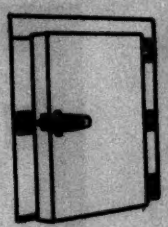
- Ideal where space factor is limited
- Recommended for Freezer Areas
- Available for manual, air, or electric operation
- Mechanically operated doors open and close in less than 4 seconds





LOW TEMPERATURE INFITTING AND SUPER FREEZER OVERLAP DOORS

- Low Temperature Doors for +10 to —20° F
- Super Freezer Doors for —0 to —100° F
- Both types available with No. 51 electric defrosters
- Extra heavy duty hardware applications

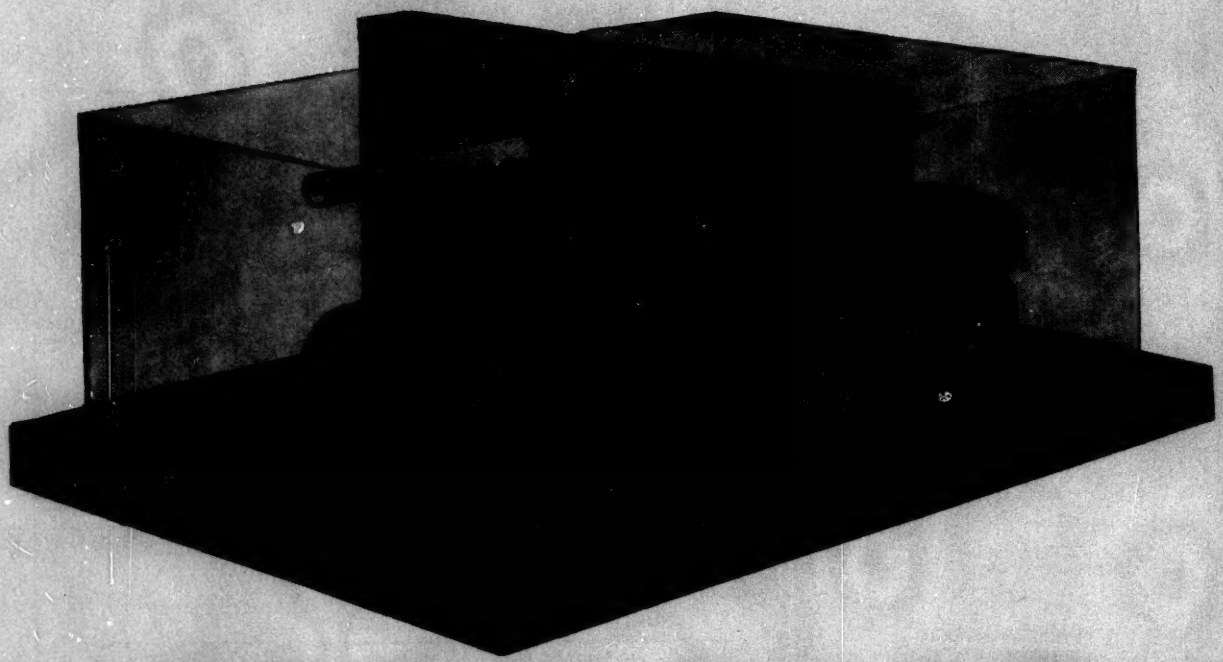


New!

FULLY AUTOMATIC ELECTRIC DEFROSTERS

- Underwriter's Approved—An exclusive First with Butcher Boy
- Flexible "silicon" covered (not lead covered) heater cables
- Furnished with calibrated "thermostat"—economical heat control

Rats gnaw right through some insulations . . .



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Industrial Refrigeration

November, 1957

Now in its 66th Year of Publication

Number 5

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J. F. NICKERSON, Founder

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The Cover:

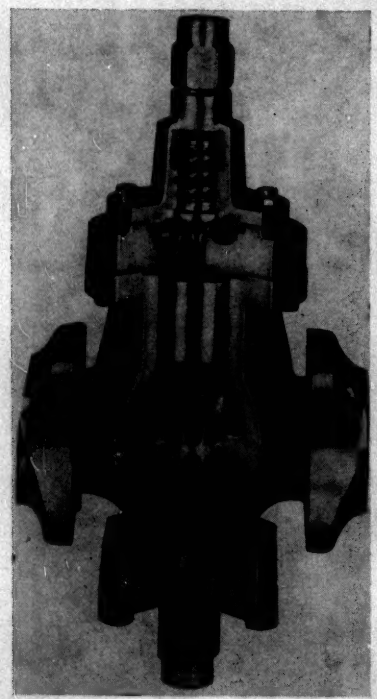
Germination of grain, one process in producing malt for brewing, requires most suitable conditions of temperature, moisture and oxygen supply. One utility in the "climate factory" of the Albert J. Schwill & Co.'s "ranch style" malt house, Chicago, is this 470-ton gear-and-seal type centrifugal water chilling unit. Installation of the refrigerating plant enabled the firm to carry on malting operations independent of local weather conditions.

What's New

MACHINERY
APPLIANCES • PROCESSES

New Evaporator Regulator

A NEW 2-1/2 inch port size series of back pressure regulators announced by Refrigerating Specialties Co. of Chicago includes the following features: Modulating V-port seat provides precision evaporator control and eliminates chatter under light loads; great compactness for a regulator of this port size; extreme simplicity of parts.



Evaporator regulator made by Refrigerating Specialties Co.

Ideal for close regulation of chillers, flooded or direct expansion evaporators, or for hot gas defrosting pressure control, this regulator is available with optional features such as electrically compensated, pneumatically compensated, holdback, dual, and electric stop. This V-ported design regulator is now in production for all sizes from 3/4 to 6 inch port for Refrigerants 12, 22, ammonia and many others.

Thaw Detector For Frozen Foods

THERMOCHROMOTEX is a disposable temperature indicator which will positively signify when a frozen food shipment has received certain predetermined limits of temperature treatment. The St. Eloi Corp. has introduced Thermochromotex which is based upon chemical rather than mechanical principles.

Small sealed glass ampoules, measuring about two inches by three-eighths inch diameter, are partly filled with a water clear liquid. When an ampoule is cooled to its operating temperature, which may lie at any temperature between minus three and minus 22 C (26 F and minus 8 F, respectively) according to the formula used, the liquid freezes and turns straw yellow in color. The yellow color will remain if the Thermochromotex ampoule is cooler than its operating temperature.

In the event that the Thermochromotex is allowed to thaw at any temperature above its operating temperature, the liquid turns a bright red color. Subsequent refreezing will not change the red color, and thus the red liquid serves to indicate permanently that the Thermochromotex ampoule has thawed.

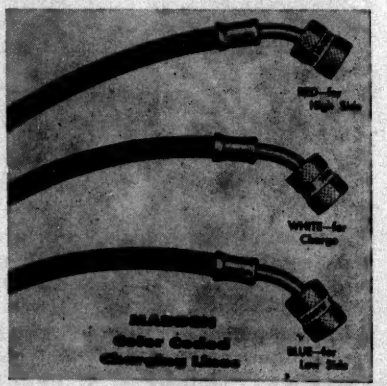
Since the red formation is actually a suspension of fine particles which have been released from the original solution, these particles will tend to slowly settle, finally forming a fine bright red line at the base of the ampoule. The amount of settling serves as an approximate index of the length of time the ampoule has remained thawed, reaching minimum proportions in about half an hour.

An expected application would be as an indicator for frozen products, especially in application to show whether the product remained frozen in transit.

These Thermochromotex ampoules are currently available at $117.40 per thousand in lots of one thousand and at $72.50 per thousand in lots of one hundred thousand. St. Eloi Corporation is located at 3509 Debolt Road, Newton, (Cincinnati 44) Ohio.

Color Coded Charging Lines Introduced

FULL production of new color coded charging lines has been announced by Madden Brass Products Company, Aurora, Ill. The color coded lines are in three colors: Red for high side, White for charge, and Blue for low side. Color coding makes servicing easier, and simplifies work in close quarters. Line tracing is completely eliminated with Madden new color coded charging lines, as it is always certain just where the hose is hooked up. Color coded charging lines contain the regular Madden quality features: flexibility, all brass barb and ferrule for positive seal, tubular gasket that won't pop out, and finger-grip knurled nut for easier handling. Packaged in dustproof polyethylene bag.



New Refrigerated Centrifuge

A NEW Refrigerated Size No. 2 Centrifuge with push-button control panel has been added to the Chicago Surgical & Electrical Company extensive line of laboratory centrifuges. Designated as Imperial Model 20-R, size 2, the new centrifuge has many exclusive features such as cabinet construction with storage space for accessories; formica working top; ball-bearing motor lubricated for life; aircraft-type vibration mounts; electric brake eliminating brake shoes, brake drums and brake bands; safety switch to prevent operation of centrifuge if cover is open; hermetically-sealed refrigeration compressor with F-12 refrigerant; and push-button panel with speed indicator, speed control, knobs, braking switch, temperature indicator, etc.

New refrigerated No. 2 centrifuge with push-button control panel.

Temperature range down to minus 20 C. depending on type of head and accessories used. The New 20-R Imperial Centrifuge will accommodate all standard size No. 1 and size No. 2 heads and accessories. Entire unit is mounted on casters for mobility and size of cabinet is 38 x 29 x 37 inches high. Maximum speed is 6000 rpm controlled by built-in auto-transformer.

Positive Defrost Control

THE "Bossman Control" offered by the Thompson Refrigeration Corp., Chicago, Ill. is a positive temperature control system designed and engineered to protect costly inventories of perishable products. It provides in one package all the necessary control equipment to create perfect commercial refrigeration temperatures and conditions and to (a) dial the temperature instead of depending on pressure control settings;

(b) dial a positive defrost on each cycle, and (c) dial a "frost-locked cycle" should it occur and to permit the equipment to return automatically to normal operation.

Feature of the control is the perfect sequence of operation provided by three thermostats each doing a separate job. No. 2 thermostat controls cut-in only. No. 3 controls cut-out only and No. 1 controls the anti-frost lock. Adjustments on one thermostat do not affect another.

The control stops costly frequent temperature service, gives higher system of efficiency and lower utility cost. It provides higher humidity and less shrinkage of product. Colder ranges are obtainable down to 30F product temperature with no frost accumulation on coils.

Low Temperature Chilling Machine

A NEW low-temperature chilling machine will be shown the first time at the Metals Show in Chicago by the Harris Refrigeration Company, Cambridge, Mass. Designed for production chilling, the machine is used to achieve complete stability and maximum hardness in the metallurgical processing of metal parts.

Among the latest materials adaptable to this type of processing are the new precipitation-hardening stainless steels which provide higher strength/weight properties. These materials have already found wide application for aircraft and missile parts working up to 800F.

Known as Model 10L-2, the new machine has a 10 cubic feet capacity with a chamber 30 inches long by 24 inches wide by 24 inches deep. Its outside dimensions are 76 inches long by 35 inches wide by 42 inches high. Its temperature control ranges from 0 to minus 150F. Other chamber sizes are available from 6 to 45 cubic feet with configurations to accommodate sheets, bars, or irregularly shaped parts.

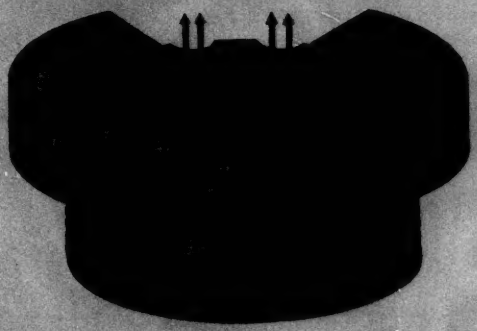
The chamber can be filled with convection fluid for rapid cooling of parts by liquid immersion, or it can be provided with an air circulator to chill parts in air. Capacity is available to chill quantities of steel at the rate of from 100 pounds per hour up. Chilling chambers are constructed with double walls of 16-gauge steel, electrically welded and finished with a non-corrosive coating of hot-sprayed zinc. Stainless steel chambers are also available. Chamber walls are insulated with at least five inches of silica aerogel which has a K factor of .11 at minus 150F.

The efficient honey-comb cooling system eliminates easily damaged piping around the chamber walls. Coolant channels are embossed between the double steel walls.

PERFORMANCE!

New BALL VALVE

INCREASES THE PERFORMANCE OF ANY COMPRESSOR—OLD OR NEW



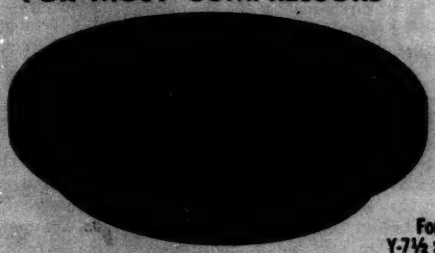
New "BV" Ball Valve passes 26% more gas in actual tests conducted by a leading independent research organization. Users report amazing increases in performance when they install Ball Valves. And, not one report of failure in operation—Ball Valves are free from valve breakage!

EASY TO INSTALL

No drilling or tapping — BV is simply screwed in, then locked in place in seconds with the special locking ring.

STANDARDIZED

SUCTION VALVE ASSEMBLIES FOR MOST COMPRESSORS



For: Y-7½ x 7½

For information on improving your compressor performance, send us the name, bore, stroke and speed of your machine.

BALL VALVE CO.
P.O. Box 53 • Kansas City 41, Mo.

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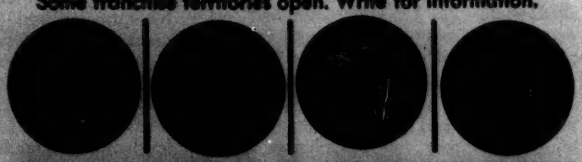


CARRIED IN STOCK FOR [illegible] COMPRESSORS

New Apparatus For Spraying Insulation

THE successful spraying of urethane foam insulation on the walls and ceiling of a building has recently been demonstrated through the use of specially engineered new type of spraying apparatus. Developed by the Minnesota Mining and Manufacturing Company, this new equipment has been used to insulate a new ice-house at the Du Pont Company's Chambers Works at Deepwater Point, N. J. The entire application took six days of spraying time.

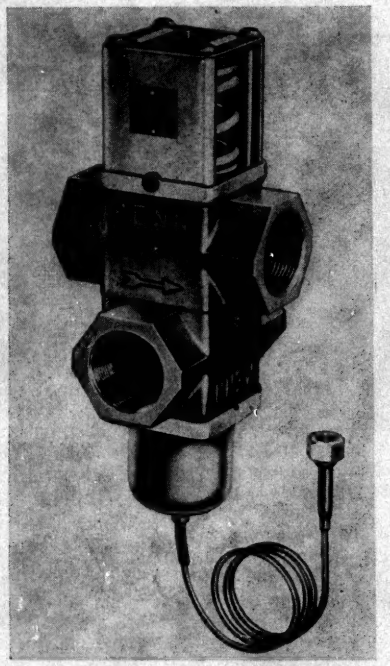
Urethane foam has already been used to insulate pipes and tanks of all sizes. While material costs are higher than conventional insulation, savings in application time usually result in a lower over-all cost. The unique characteristics of the new spraying equipment are the mixing chamber in the spray gun itself and the proportioning of the material from the intricately engineered metering apparatus. This metering equipment is attached to the spray gun by three separate lines, one carrying the prepolymer, another for the catalyst, and the third for air.

Flow of the material can be controlled accurately to one-half of one per cent. The proportioned materials are mixed in the small chamber of the gun in about 1/30th of a second, picked up by the atomizing air, and sprayed out to foam up against the surface. By pushing a button the operator can shoot foam from the gun in a continuous stream.

Water Regulating Valve For Cooling Tower

A NEW line of water regulating valves, available from Penn Controls, Inc., Goshen, Ind., is especially designed for maintaining uniform refrigerant head pressure regardless of the water temperature returning from the cooling tower.

The valve is applicable to commercial refrigeration and air-conditioning systems which may fall well below their rated capacities unless head pressure is maintained within reasonable limits. It provides automatic regulation of water flow, to keep the water temperature from falling too low for efficient operation because of low air temperatures at the tower. The valve's three-way action permits water to be diverted from the condenser into a by pass line to the tower nozzles. This eliminates the adverse effect on nozzles or wetting surfaces due to flow restrictions.



Series 3246 three-way water regulating valves for cooling towers.

These new valves, designated as series 3246, are the first valves operated directly from refrigerant head pressure, to be offered for this special service. They are available in 1/2, 3/4, 1 and 1-1/4 inch N.P.T. sizes for both R-12 and R-22 refrigerants.

Cooler Wall Finish

A NEW type of cooler and freezer wall finish has been announced by the Adhesive Products Department of Swift & Company. The new material is specially designed for finishing board type insulation, principally in low temperature freezer and cooler rooms. It is designed as Swift's Adcote.

Swift's Adcote is supplied as a two component product, a dry powder and a liquid which are mixed just prior to use. The material is normally applied by trowel although successful applications have been made by brushing and by spraying with special spray equipment. On most types of surfaces Adcote is usually applied in two coats to a total thickness of approximately 1/8 in. It can be finished in varying degrees of smoothness from a textured or sand finish to a smooth finish. Painting is not necessary.

Adcote is real white but may be tinted prior to application. Installations have shown good whiteness stability, and no yellowing has taken place. Resistance to moisture, chemicals, vermin, rodents and mold is excellent. The material is highly fire retardant.

In addition to its use on insulation, tests indicate that it may also have many other applications, such as refinishing interior concrete surfaces, or brick walls.

New Solenoid Valves For Industrial Use

THE introduction of a new low cost line of solenoid valves for general industrial applications is announced by The Jackes-Evans Manufacturing Co., St. Louis, Mo. The new "Series J" valves incorporate the construction features of the standard J-E line, but are offered in an attractive price range. These J-E "Series J" solenoid valves are designed for the flow control of water, air, light oils, brines, low pressure steam, industrial gas, L.P. gases and many other non-corrosive fluids, with a maximum

operating pressure differential of 150 psi. They can be mounted in any position, have only two moving parts and utilize the principle of pilot port operation. Their synthetic diaphragms are said to be unusually durable and have been successfully operated through millions of test cycles with little or no water.

New Motor Starters

COMPLETELY front accessible, a new line of 2300 to 4160-volt starters (Type H) for full or reduced voltage starting, reversing or non-reversing, dynamic braking or multi-speed control of squirrel-cage, synchronous or wound rotor motors has been announced by Allis-Chalmers. The new starter is compact and versatile with the basic unit measuring only 34 inches wide by 32 inches deep.

All components of the new starter were separately tested to prove individual ratings and mechanical strength. The new starter is available with either air-break or oil immersed contactors up to 1500 hp at 233 volts, or 3000 hp at 4600 volts. Short circuit protection of 150,000 kva at 2300 volts and 250,000 kva at 4160 or 4600 volts is provided by current limiting fuses.

PRESS BRIEFS

Apples Preserved by Radiation

A PROCESS for preservation of sliced apples through radiation sterilization is described in a report of research released through the Office of Technical Services, U. S. Department of Commerce, by the Quartermaster Food and Container Institute for the Armed Forces.

Test results showed that mature apples were a better raw material than immature apples. Processing of the apples immediately after harvest was found to be a better procedure than allowing them to ripen by storage at 75 F before processing. Blanching the slices in dilute sugar solutions with or without the presence of calcium gluconate and freezing proved superior to deaerating in chemical solutions.

Government Building Air Conditioned

THE two largest and most powerful single centrifugal refrigeration units ever built will comfort cool the Department of Agriculture's South Building, Washington, D. C., one of the largest office buildings in the world. Constructed in the early 30's, the building is divided into numerous wings and courts and contains a total of 2,056,400 sq. feet of floor area. The South Building alone contains 1,313,930 net sq. feet of office space, and the adjacent North Agriculture Building contains 110,000 net sq. feet.

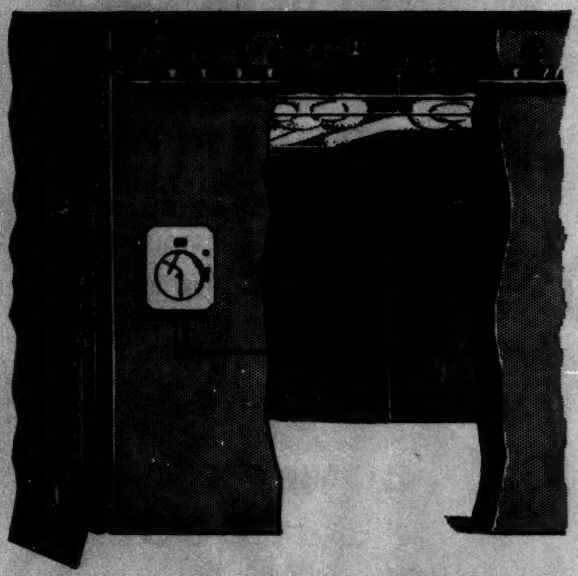
The two centrifugal compressor water chiller units, now being built by Worthington Corporation at the Harrison, N. J. and Ampere, East Orange, N. J. plants, will be capable of providing 2900 tons of cooling each when installed late next spring. They will cool 9000 gpm from 57.47 to 42 F. utilizing a series arrangement and will be located in a new extension to the present Central Heating Plant for these buildings. The chilled water for air conditioning the huge, seven-wing, four-story high South Building and the North Building across the street, will be circulated in a closed system through an underground passageway linking the buildings. Other equipment which will be part of the air conditioning system includes two speed increasing gears, two 3000 hp synchronous motors and controls.

This project was designed by Karsunky, Weller and Gooch, architects and engineers of Washington, D. C. in conjunction with Public Buildings Service, General Services Administration, Washington, D. C.

Frozen Food Packers Name Task Force For Handling Frozen Foods

A FIFTEEN-MAN all-industry Task Force has been announced by the National Association of Frozen Food Packers to work on ways and means of obtaining improved handling of frozen foods from packer to consumer. Sterling B. Doughty, NAFFP president and chairman of the Task Force announced 100% acceptance of invitations to participate from all industries involved in the movement of the products.

"Such complete acceptance is the surest indication that the aims of the Task Force will be achieved," Mr. Doughty said. "It proves that everyone who has a stake in frozen foods is aware that mishandling does exist, that it is having a detrimental effect on industry expansion, and that it can be eliminated."



Witness for the PROTECTION . . .

FOR your protection . . . and the protection of your customers' food. The Taylor Locker Room Thermometer gives you an accurate, continuous permanent record of the temperature inside your locker room—from a convenient point outside the room.

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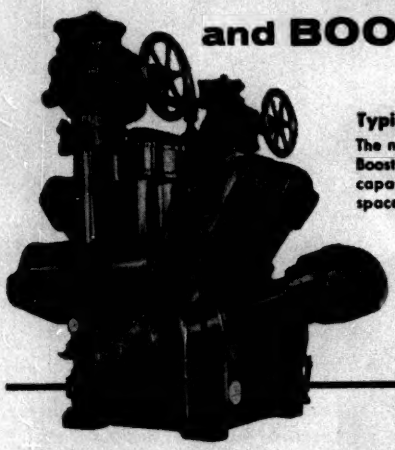
Investigate type "K"

COMPRESSORS and BOOSTERS



Typical Example: The new CP 10 Cylinder Booster. Maximum capacity in minimum space. Ask about it!

WHETHER the most economical answer is one of the latest model CP Type "K" Compressors —a two-stage Booster-Compressor System—or a complete new refrigeration layout—you'll find a full range of capacities and models that lets you match the equipment to the job exactly. You'll get the long-term economy, solid dependability and sound engineering for which CP Compressors and Boosters are famous.

WHAT'S MORE, you'll get the extra benefits of CP "Job Engineering"—the advanced "know-how" that CP Engineering has been developing and applying for generations. It costs no more—but it can save you a lot! Write—tell us your problems—let us help you with a solution.

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The Task Force has two objectives: (1) To impress upon all handlers of frozen foods the downgrading effects which exposure to temperatures above zero have upon the products; and (2) To inform and educate, by every means available, on proper handling methods.

The National Association of Frozen Food Packers started the program after release by the Western Utilization Research Branch of the U. S. Department of Agriculture of a report on the effects of poor handling on the color, flavor, texture, and nutritional value of frozen foods. President Doughty issued an invitation to Frank D. Arn, merchandising director, Florida Citrus Commission; Dr. M. J. Coply, director, Western Utilization Research & Development Division, USDA; William Dalton, executive vice president, National Association of Refrigerated Warehouses; H. C. Diehl, director, The Refrigeration Research Foundation; Fred Freund, director, Traffic Department, American Trucking Association; G. Vander Hooning, National Association of Retail Grocers; L. S. Martin, secretary-manager, NAFFP; C. E. Jackson, general manager, National Fisheries Institute; Dr. W. M. Keeler, director of research, Association of American Railroads; Curt Kornblau, director of research, Super Market Institute; Col. C. S. Lawrence, business manager, Institute of Food Technologists; L. F. Norwood, federal extension specialist, U. S. Department of Agriculture; H. K .Schauffler, executive director, National Frozen Food Distributors Association; G. B. Travis, vice president for merchandising, National Association of Food Chains; S. T. Shaw, vice president, Safeway Stores, Inc.

Studies of Irradiation For Food Preservation

AN enormous number of reports on research on irradiation are being published nowadays. Approximately 90 universities and governmental and industrial groups are active in the research program of the Quartermaster Corps, and some hold two or more contracts. Food irradiation studies are under way elsewhere, notably in England, and a number of corporations are conducting research independently of the Quartermaster Food & Container Institute for the Armed Forces.

About a year from now, a pilot-sized plant, capable of irradiating 3000 lbs. of food per hour, will be ready for operations at Sharpe General Depot, Lathrop, Cal., under the auspices of the Department of the Army. It will provide larger production of foods for research and testing, information on commercial equipment and data on costs. It will be able to process all foods.

A quick glance at research summaries in the report indicates that some meats and fish are promising, but various problems of flavor and color remain. Fruits and vegetables can be expected to require refrigeration as an adjunct to radiation. Much basic chemical research is under way to explain irradiation-induced changes and possibly counteract them. In a recent survey none of the research men are optimistic about the immediate future which depends on the outcome of much current research devoted to new basic knowledge of the damage that irradiation causes.—TRRF BULLETIN.

Underwriter's Publication Features Practical Articles

TWO articles of practical interest to owners and operators of refrigerating plants for industrial applications or air conditioning, appeared in the July issue of The Locomotive. One article was entitled "The Pay-Off Season" and the other, "Hit or Miss Operation".

The publication, by the Hartford Steam Boiler Inspection and Insurance Co. pointed out editorially in the first article that the heavy demands of the summer season certainly designate it the "pay-off season" for past care given to air conditioning and refrigeration apparatus. They pointed out that accidents occurring in the peak season meant heavy expenses for repairs, loss of use, spoilage, etc. If conditions are such that the cost of inefficient operation is preferable to the owner to shutting down for a short-time maintenance inspection, the article noted, it stands to reason that the concern cannot afford the long outage time an accident would cause. Yet, the insurance firms' records show that most accidents happen at that time of the year.

The second article in this publication for owners and operators of such equipment, cites the unfavorable odds for those who practice hit-or-miss operation. The article points out the need for correct operation of equipment. It flatly states that the total number of accidents known to result from incorrect operation is unduly high. An error may be as elementary, according to The Locomotive, as the too sudden opening of a suction valve on an ammonia compressor, or failure to purge an oil trap on an ammonia line.

Mauretania Liner To Be Air Conditioned

THE Liner Mauretania will be equipped with a complete air-conditioning system serving passenger and crew accommodations throughout the ship during her stay at Liverpool from October 3 until January 15. In addition to the 100 percent air conditioning of the public rooms, every stateroom in the Mauretania will be equipped with regulators which will permit passengers to adjust atmospheric conditions in the stateroom to suit their individual comfort. The system employed, unlike many other cruise ships, also allows the passenger the choice of opening the stateroom portholes when desired. Two additional turbo-generators will be installed to cope with the extra electrical load.

Another 1,000 Cars For Pacific Fruit Express

PACIFIC Fruit Express Company has undertaken the construction of 1,000 mechanical reefer cars to cost approximately 20 million dollars. K. V. Plummer, vice president and general manager, made the announcement in mid-September. Construction of the cars will be by PFE in its own shops. Initial deliveries are expected in March 1958 with completion by February 1959.

The announcement indicated that 500 of the new cars will be 50 feet long and designed expressly for transporting frozen products. The remaining 500 will be 40 feet long and equipped to handle either frozen foods or fresh fruits and vegetables. According to the release, use of the latter type of mechanically cooled cars will be the road's first venture in dual refrigeration application.

Simultaneously with the announcement, the National Association of Practical Refrigerating Engineers, Educational Committee, was releasing the news that R. F. McKee, mechanical engineer for PFE would be on the meeting program at Chicago. McKee is to discuss the 500-ton Ogden installation of his company. This plant, just completed, is one of the most novel water-ice producing installations in the United States. It features Refrigerant-12 on sodium chloride brine systems, refrigerant compressed by centrifugal machines, and many other features which are considered unique in the industrial ice manufacturing field. Construction of this plant and modernizing of other PFE water-ice installations indicates that ice and salt refrigeration is not being replaced by the mechanical cars introduced by the company.

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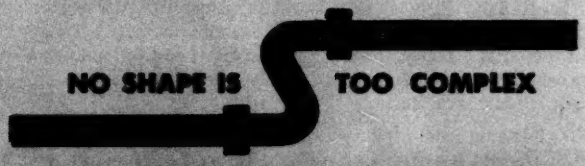
The quickest, easiest way to stop wasteful heat absorption is to cover all pipes and ducts with OZITE Standard Hair Felt. It gives better insulation because it is made from 100% genuine cattle hair, nature's own insulation.



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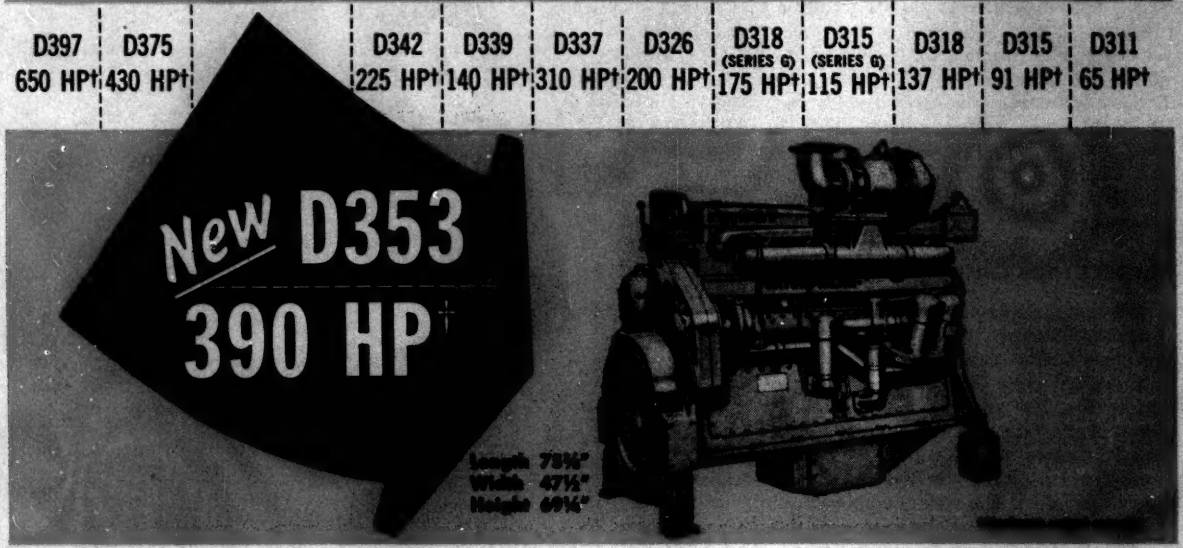
CATERPILLAR ANNOUNCES

Another heavy-duty engine in the world's most advanced line of Diesels

D397 650 HP† | D375 430 HP† | D342 225 HP† | D339 140 HP† | D337 310 HP† | D326 200 HP† | D318 (SERIES G) 175 HP† | D315 (SERIES G) 115 HP† | D318 137 HP† | D315 91 HP† | D311 65 HP†



The engine that delivered outstanding performance in the famous D9 Tractor is now available as the D353 Industrial Engine, Electric Set and Marine Engine. Like all modern CAT* Diesels, the D353 incorporates in its design the advanced features developed by Caterpillar in a quarter century of diesel leadership. Its four-cycle design delivers the long, effective power stroke that puts power to more efficient use than other types of engines. Its fuel system requires no adjustment. There are no cylinder ports to clean. And it operates on a wide range of fuels including premium diesel fuels as well as low-cost No. 2 furnace oil *without fouling.* All these and other features add up to performance that no unit in its power class can match.

With the addition of the D353 to the Caterpillar Engine line, you now have an even wider choice than ever for your requirements. Engines are available up to 650 HP (maximum output capacity) and electric sets up to 350 KW (continuous duty). Either as original or replacement power, there's one among hundreds of different arrangements that exactly meets your needs. Leading manufacturers of machinery can supply these models in the equipment they build.

For complete information about the new D353 and other Cat Diesels, see your Caterpillar Dealer. Let him show you how diesel leadership based on a quarter century of experience can engineer the modern heavy-duty diesels of tomorrow.

The new Cat D353 Engine is a six-cylinder, four-cycle, valve-in-head turbocharged diesel. It is available as an electric set rated at 200 KW (continuous duty) and as a marine engine. A full line of matched attachments is also available — items such as air, electric and gasoline starting systems; clutches; bases; controls and governors; cooling systems and mufflers.

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Through the years, Caterpillar Engines have earned a reputation for *honestly rated power.* Now Caterpillar backs this reputation with a *notarized certificate* covering the horsepower capabilities of each engine. You have a right to demand *certified power* when you invest in an engine. You get it when you buy from your Caterpillar Dealer!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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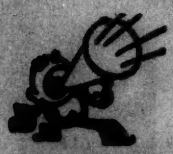

In the Spotlight

DEPARTMENT STORES, office buildings, and heavily occupied institutions, have an interest in the Practical Refrigerating Engineer this month and again in December. Howard A. Wolfberg, controls engineer for the York Corp. Central District, outlines engine and compressor controls at the very famous Southdale Department Store, near Minneapolis. These are the nerves that manipulate the refrigerating plant which furnishes heating and cooling for a boiler-less plant.

Wolfberg, invited to be IR's guest editor for these two issues emphasizes the need for operating and maintenance labor to upgrade itself to practical technician. He also cautions management that such plants are cheap-labor savers, but require better re-imbursed supervisory and maintenance forces to cope with system intricacies.

TYPICAL users of industrial (liquified) chlorine, a fast growing modern product, are the manufacturers of the polyvinyl chloride pipe which is rapidly winning acceptance in accessory refrigeration and air conditioning applications. Myriads of other uses for chlorine have tripled production in 20 years. Quantity production of a quality chemical, and its liquefaction for handling on the market, is a valued refrigeration application. Read on page 13 how 227 tons of refrigeration effect renders a big assist in the production of 250 tons of chlorine.

PROPER Commodity Temperatures are essential to the maintenance of quality of fresh vegetables and fruits shipped in standard railroad refrigeration cars. The optimum temperature is not the same for all commodities. And maintenance of temperature depends upon precooling practices and upon the selection of appropriate transit protective services. The use of a thermostat to interrupt the operation of electric fans and baffles to retard natural circulation, described in this article, shows promise as a method of controlling refrigeration. The subject is discussed fully in the article starting on page 15.

A PATENT on a hydraulic drive for refrigerating compressors has been designed for application to certain makes of stock compressors, while other developments involve an entirely new idea of compact opposed piston reciprocating compressors, principally for transportation application. For description and illustration see page 19.

EFFICIENT use of refrigerant, and combinations of machinery for moving it in both liquid and gaseous states, is as important to the modern milk and ice cream plant as the new processing, packaging and product handling equipment. For a pictorial display of the new refrigerating plant at the Carnation Co., Seattle, and that firm's ideas on economic heat removal, see page 22.

USE OF ROTARY compressors for high stage work in commercial systems appears more likely than in the past. A new Orleans inventor has an improved version which is said to effectively seal off any internal gas by-passing during compression, indicating probable use at higher pressures. Read about the Blackman compressor on page 28.

"PUBLIC REFRIGERATED services will become more and more important as chain grocers and all who handle the many items of frozen products come to know the full cost of protecting and marketing these sensitive and valuable products." A. N. Otis, Merchants Refrigerating Co. in Food Processing.

FROZEN CANDY? A new type of frozen candy, boasting improved nutritional properties, was foreseen by James J. Albrecht, special instructor in food engineering at Illinois Institute of Technology, at a joint technical session in Chicago recently of the National Confectioners' Assn. and American Association of Candy Technologists.

"IN THE recently released 1956 sales report of the National Association, decline of our business in Texas and Oklahoma is shown to have been at a far slower rate than that in other sections of the country. Climate has a lot to with this, of course, but we believe the well located drive-in ice and food stores developed originally by Texas ice men and the utilization of other convenience outlets, are also important factors."—General P. A. Weatherred.

FROZEN FOOD Packers should police the reputation of their brand throughout the distribution channels according to C. Gordon Griffith of Plantation Frozen Foods, Uleta, Fla. at the 8th Annual Citrus Processors Meeting at Lake Alfred, Fla. Mr. Griffith represented the National Frozen Food Distributors Association on a panel considering the topic, "How can proper handling and storage of frozen orange concentrate be accomplished to protect the quality of this product?"

STRAWBERRIES left in the Antarctic more than 40 years ago were eaten and reported "delicious" by explorers Captain Robert Scott and Sir Ernest Shackleton. The crew also tested cocoa left by early explorers and reported it had lost none of its flavor after four decades.

A STUDY of materials handling by refrigerated warehouses, conducted by the Marketing Research Div. of USDA has uncovered some interesting facts in this important labor cost and time study as described on page 21. Time studies have provided data on elapsed time required for performing various operations.

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1,000 to 6,000
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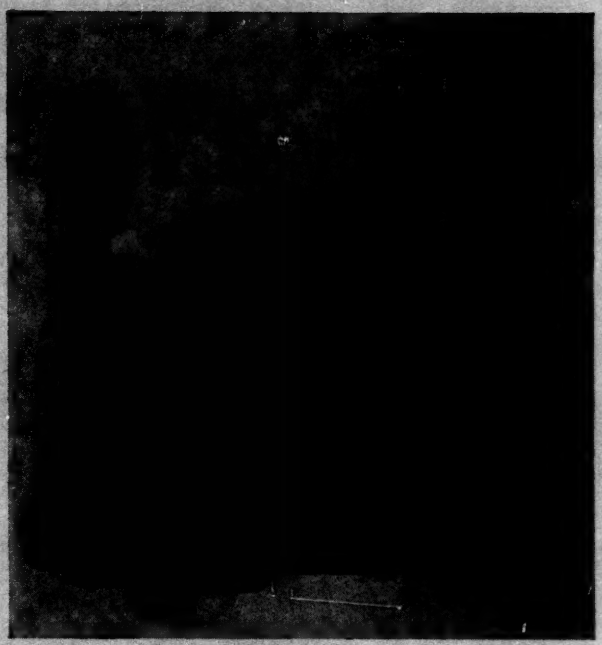
Chlorine Liquefaction

Chemical Condensing With Refrigerant-12 Recirculating System



GEO. BRILEY

CHLORINE—once a very objectionable by-product of caustic soda manufacture—is now one of the most important products of the chemical industry. Formerly used principally as a disinfectant, bleaching agent, and for a few commercial compounds, this chemical has become an essential to modern materials and process methods. It is rated among the best oxidizing and reducing agents in chemical synthesis. Demand for chlorine continues to grow. From a 1939 use of 540,000 tons the user demands reached to 1,500,000 tons in the early 1950's, and the spiral continues upward in this growth industry.

One of the three major Southwest producers of liquid chlorine is Diamond Alkali Company, Pasadena, Texas. The plant is located advantageously on the Houston ship channel near Houston's large seaport. Brine, a source of chlorine, is available from Barber Hill, Texas, 17 miles away. Also, electric power required in the production of this chemical, is available to Diamond Alkali at what is considered by many to be among the lowest over-all utility rates in the country. Of course, Diamond Alkali produces many chemicals in their plant other than chlorine.

Liquefaction of chlorine is only a portion of the process in producing a readily handled product for marketing. The chlorine must be first manufactured; i.e., taken from the source. For a schematic flow diagram of the production and liquefying process, see Fig. 1, a typical chlorine condensing cycle.

George Briley is Branch Manager, York Corp., subsidiary of Borg-Warner, Inc., Houston, Texas. This description of industrial refrigeration in a modern chlorine plant is believed to be among the first published on the subject in media devoted to refrigeration.

Production of Chlorine

Chlorine is produced from electrolysis of a sodium chloride (brine) solution in a diaphragm cell. Filtered, heated brine is fed to electrolytic cells producing caustic soda, hydrogen, and chlorine gas. Caustic soda and hydrogen are removed to separate process areas. Wet chlorine gas is then cooled to approximately 60 F and directed through drying towers. The dry gas is then compressed and scrubbed. At this point the chlorine must be liquefied for distribution in cylinders, tank cars, or direct to customers through pipe lines.

Apparatus of Own Design

In the production of chlorine at it's Houston Works, Diamond employs a special diaphragm type chlorine cell which is of their own design. It's main objective is to reduce building size and costs, and reduce maintenance. Having enjoyed considerable success in that undertaking, they applied similar effort on the chlorine condensing problem.

Diamond Alkali's problem lay in existing liquefaction equipment which did not quite meet their requirements. A flexible system was needed—one with more than one chlorine condenser, and more than one refrigerant condenser. And, a refrigerant that operated at above atmospheric pressures was desirable. These were the major requirements, other than it had to be an efficient and economical system.

What did Diamond Alakli employ? Two York multi-shell primary liquefaction systems. Each of these systems is capable of liquifying 250 tons of chlorine per day. Gas entering the liquefaction system contains 95 percent chlorine and five percent inerts. The refrigeration duty is 227 tons of refrigeration at minus 20 F evaporator temperature. The liquid chlorine is cooled to minus 5 F.

Fig. 2 is a schematic of a single system showing principal components. Each system consists of: six single-pass 20-in. diam. x 20'0" long chlorine condensers; one York model 4BS, four-stage Refrigerant-12, centrifugal compressor; one flash-type refrigerant intercooler; two Refrigerant-12 condensers, 38 in. diam. x 12 feet long; one low-pressure receiver, 36-in./44-in. x 16 ft long; one Refrigerant-12 pumpout system.

Chemical Condensers

Chlorine condensers are arranged in two banks of three each. The chlorine circuit is so arranged that individual shells may be isolated from the system, evacuated of refrigerant and steam cleaned if necessary. Refrigerant-12 (dichlorodifluoromethane) at minus 20°F is used as the refrigerating medium. It is circulated through the shell side of the condensers by means of a liquid pump. This assures high heat transfer and

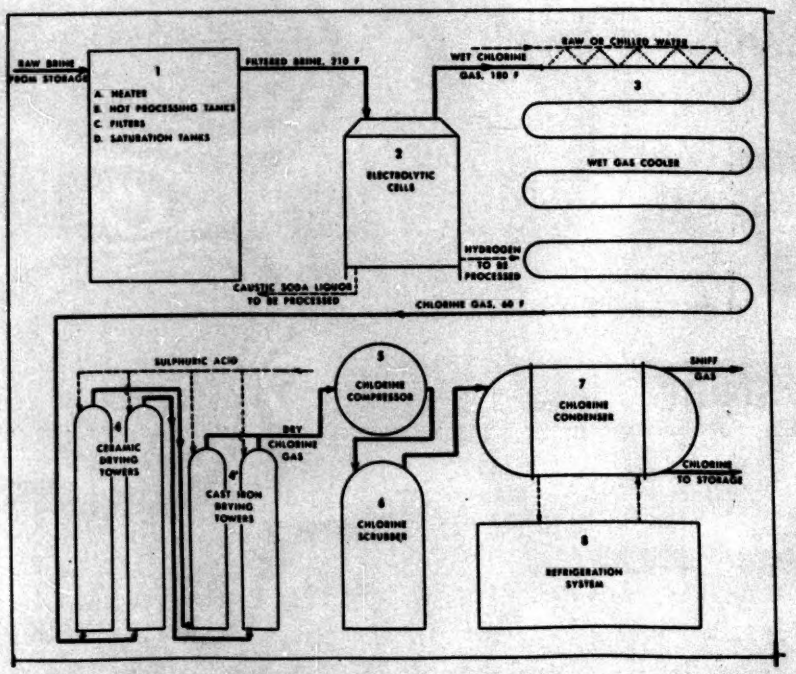


Fig. 1—Typical chlorine condensing cycle such as used in the two 225 ton systems at Diamond Alkali Co. For details of the chemical condenser and refrigerating system, see Fig. 2.

eliminates static head penalties. Each condenser contains approximately 700 sq. ft. of external tube surface.

The York Model 4BS, four-stage centrifugal compressor is driven by a General Electric Co. single-stage non-condensing steam turbine developing 629 bhp. The compressors employ fabricated stainless steel impellers. Suction is taken at approximately 30 psig from the low-pressure receiver and discharged to the two condensers at 165 psig, approximately.

Refrigerant Vessels

A single-stage intercooler of the flash type is employed to reduce the centrifugal compressor horsepower requirements. Flash gas is fed back to the centrifugal between stages.

The two York Refrigerant-12 horizontal shell and tube condensers are equipped with special corrosion resistant metal in the tubes. This is required in order that ship channel water (brackish) can be used for condensing purposes. Dual condensers are employed so that one may be cleaned while the system is in service.

The pump-out compressor and receiver is used to evacuate any part or parts of the system for cleaning or maintenance.

The low pressure receiver or flash tank is a storage vessel. In this vessel the refrigerant is flashed to minus 20° F. for circulation to the chlorine condensers. It is sized to maintain proper liquid quantities for circulation during variable loads.

Liquid Refrigerant Pump

A liquid pump with oil type shaft seal is used to circulate the minus 20 F refrigerant liquid from the low pressure receiver through the chlorine condensers and back to the low pressure receiver. As previously noted this method effects the most efficient heat transfer.

A system of this type was highly desirable for many reasons. According to the manufacturing firm it is very flexible, easy to maintain, and is highly efficient. It is usually extremely difficult to obtain such close approach between the coolant and the liquid chlorine with systems of any other type, and Diamond Alkali indicates it has filled their requirements.

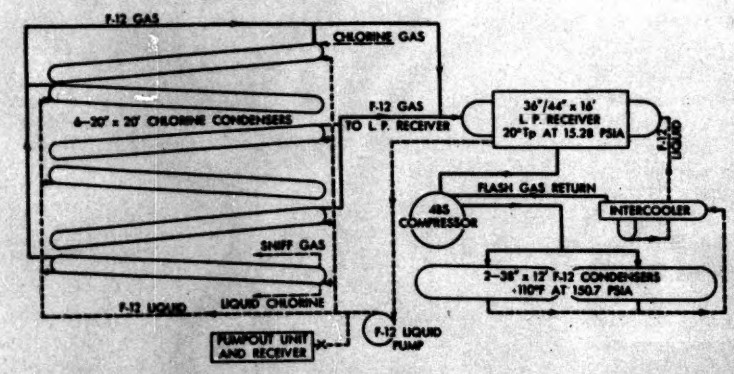


Fig. 2—Chlorine condenser (7) and refrigeration system (8) shown in Fig. 1 are detailed here. Typical multi-shell chemical condenser (six coils in this example) is pictured in left half of illustration; the liquid recirculating, centrifugal compression, dual-pressure refrigerating system at right.

New Storage and Freezing Plant for Pakistan

EASTERN Industrial Agencies of Karachi is inviting participation of U. S. investors in the formation of a new company to establish and operate a plant for freezing and storing fish, shrimp, and other seafood products.

The capital required is estimated at approximately $300,000, half of which can be provided by the Pakistanian firm. In addition, Eastern Industrial Agencies also wish to secure technical assistance from the U. S. investor.

Supplemental data are available for review on loan from the Investment Development Division, Bureau of Foreign Commerce, U. S. Department of Commerce, Washington 25, D. C.

Interested firms also are invited to correspond with N. A. Quadeem, secretary of the company, 81, 82 P.M.A. Bldg., Nicol Road, P. O. Box 4221, Karachi, Pakistan.

Cold Storage Addition

A NEW one-story concrete block addition to the Loughead Cold Storage Company plant at 120 "O" Street is nearing completion, in Fresno, Calif. The addition, to cost $130,000, with equipment, will be completed in late Fall, and will provide 11,000 square feet of floor space, doubling the present capacity of the plant for cold storage of farm produce. The project is being built by S. A. Branch of Fresno.

Thermostatic Control For Fresh Perishables In Ice-Refrigerated Railroad Cars

A. A. McKILLOP, L. L. MORRIS, AND W. R. BARGER

IF THE deterioration of fresh vegetables and fruits is to be kept at the minimum during railway transit, the maintenance of proper commodity temperature is essential. The optimum temperature is not the same for all commodities. Maintenance of temperature in standard railroad refrigerator cars depends upon precooling practices and upon the selection of appropriate transit protective services. These services include one or more of the following: provision of ice in stipulated amounts at varying intervals, addition of salt to the ice, manipulation of the ventilators en route, and use of heaters. The initial temperature of the commodity, its physiological activity, the rate and extent of cooling desired, and the effect of the weather en route must be considered in the selection of a desirable protective service. Automatic temperature control would have many advantages. Thermostatic control is available in mechanically refrigerated cars, but these cars are used chiefly for the transit of frozen foods.

The authors: A. A. McKillop, Asst. Prof. of Agricultural Engineering, University of California, Davis; L. L. Morris, Assoc. Prof. of Vegetable Crops, University of California, Davis; W. R. Barger, Horticulturist, Agricultural Marketing Service, U.S.D.A., Fresno, California.

The commodity is often undesirably warm at time of loading, and it continues to produce additional heat through respiration. The transfer of heat from the load to the ice, located in end bunkers, depends on air circulation. To facilitate this transfer many refrigerator cars are equipped with fans which reverse the air movement and increase its velocity relative to that of natural convection. These fans are of two general types, electrical and mechanical, and the trend is toward the electrical type. Of the total fleet of approximately 96,000 RS-type refrigerator cars in service in the U. S., about 40 per cent are mechanical fan, 30 per cent electrical fan, and the remainder non-fan (1).

Fan-driven air circulation removes heat from the load more rapidly and more uniformly than natural convection, and in time the temperature of the commodity approaches that of the ice. The resulting low temperature is optimum for many fruits and vegetables for which the lowest temperature possible without freezing best retards deterioration and change. In fact, certain vegetables and fruits should be precooled prior to transit. Certain other commodities, however, not only do not need these low temperatures, they may be severely injured by exposure to them during transit.

Of the many vegetables and fruits subject to injury at temperatures below about 55 F, tomatoes, bananas, and sweet potatoes are well-known examples. However, cucumbers, summer squash, peppers, green beans, melons, eggplants, and most tropical and subtropical fruits are also subject to this chilling injury. The commercial importance of maintaining non-chilling temperatures has long been recognized by the banana industry, and messengers have accompanied their cars to insure maintenance of proper temperatures. More recently the tomato industry has come to recognize the value of intermediate transit temperatures and has adopted protective services designed to give desirable temperatures (2).

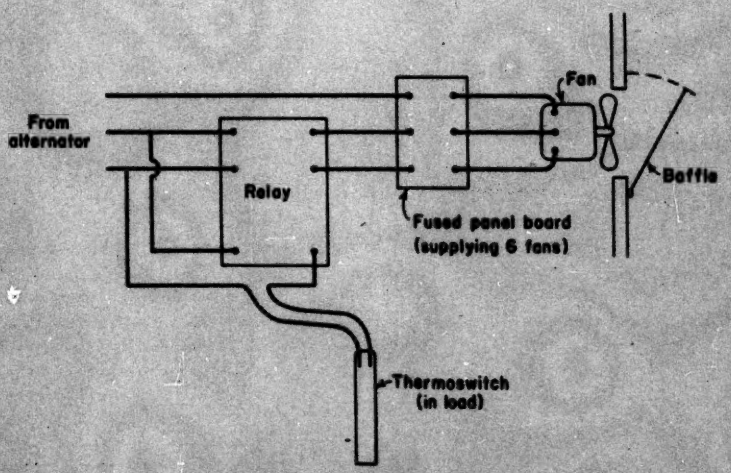


Fig. 1—The components of the thermostatic unit. The thermoswitch, buried in load, controls the electric fans through the relay mounted on car wall. The air-actuated baffles are self-closing.

Ripening During Transit

Intermediate transit temperatures may also be desired for other reasons. For example, ripening during transit is sometimes desired but will not occur if the temperature is too low, as in the case of early pears and tomatoes. For potatoes that have been skinned during harvesting, packing, and loading, temperatures below 50 F are undesirable during the first few days of transit since natural wound healing is inhibited. Furthermore, potatoes to be utilized for chips or French fries can accumulate undesirable sugar at temperatures below 50 F, causing them to darken during preparation.

The need to avoid freezing temperatures sometimes develops when the ice in the bunkers is salted. This salting is practiced to lower the temperature of the outblast air and hence facilitate cooling.

Thus, control of refrigeration in ice-cooled refrigerator cars is essential in many instances. This paper sug-

(1) Number of refrigerator cars of each type as of November 1, 1956. Mimeographed summary prepared by Refrigerator Car Committee, United Fresh Fruit and Vegetable Association.

(2) Barger, W. R., W. A. Radspinner, and L. L. Morris. 1954: Transit and ripening studied with California mature-green tomatoes, Fall 1953. USDA, HT&S Report No. 317 (also Univ. of Calif., Vegetable Crops Series No. 66).

gests a way of controlling the temperature in RS-type refrigerator cars that will better meet the requirements of many commodities. A thermostatic control unit for use in standard electric fan cars has been developed by the University of California and has been tested cooperatively with the Agricultural Marketing Service of the USDA in two accompanied transcontinental tests (3), (4).

Description of Equipment

The unit contains: (a) a thermoswitch; (b) a relay actuated by the thermoswitch for interrupting the fan circuit; and (c) baffles to curtail natural convection during periods the fans are not operating (Fig. 1).

Thermoswitch: A thermoswitch for such use must be rugged and small, specific requirements depending upon its location in the car. The switch used in a recent transit test is shown in Fig. 2. It is particularly advantageous because it is small and compact, it can be inserted into the load, and the covering protects the switch against mechanical damage and moisture. The sensitivity of this switch is probably greater than required for commercial application.

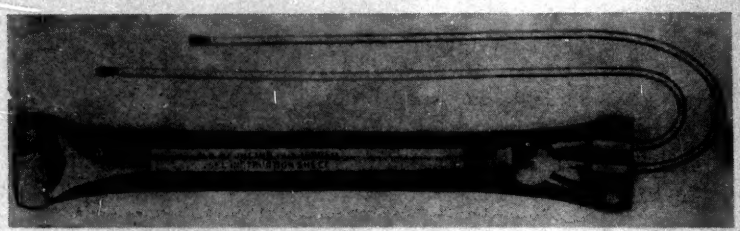


Fig. 2—The type of thermoswitch used in potato test. The size (approx. 8" x ⅞") and the plastic enclosure adapt it to placement in load. (Photo courtesy Fenwal Co.).

Relay: The power source for the electric fans is an alternator operated by the car wheel, producing three-phase voltage. A relay is needed to interrupt the three phases simultaneously. The varying speed of the train necessitates a special relay coil which will not heat excessively at high train speeds yet will be properly activated when the train is moving slowly. To meet these conditions, a commercial relay can be used if the coil is rewound according to:

$$N_1 = N_2 \frac{E_1}{E_2}$$

where, N_1 is the turns of the new coil,
N_2 is the turns of the commercial coil,
E_1 is the operating voltage of the alternator at an average train speed,
and E_2 is the rated voltage of the commercial coil.

The size of the wire chosen was the largest possible accommodating the required number of turns in the available coil space. The relays used for the transit tests were Allen-Bradley Heavy Duty Series 200 D, with a rating of 25 amps at 110 volts and 60 cycles. The new coil was designed for a voltage of 17.5—corresponding to an average train speed of 30 miles per hour.

In laboratory tests the relay operated at a minimum train speed of 10 mph and yet did not overheat at 70 mph. In actual operation the danger of overheating will be minimized because the relay will be operating in an ambient temperature lower than that of the laboratory.

Baffles: The device to curtail natural convection must be simple to operate. Presumably it can be located either at the top or bottom of the bulkhead. The bottom position is theoretically preferable since it should stop the flow of cold air under the load and reduce the cooling of the bottom layer. The top position, while probably not as effective in stopping natural circulation, has the advantage of being readily accessible.

In these tests, panels equipped with air-actuated, normally closed baffles were placed over the fan openings in the top bulkhead position. The design and construction features are shown in Fig. 3. The baffle is counter-balanced so as to be closed when the fans are not operating. Sponge-rubber weather stripping around the edges further restricts air flow (see Fig. 3). When the thermoswitch actuates the fans at a minimum train speed of 10 mph, the air-operated baffles open approximately 20 degrees. The maximum opening of nearly 90 degrees is reached at 30 mph.

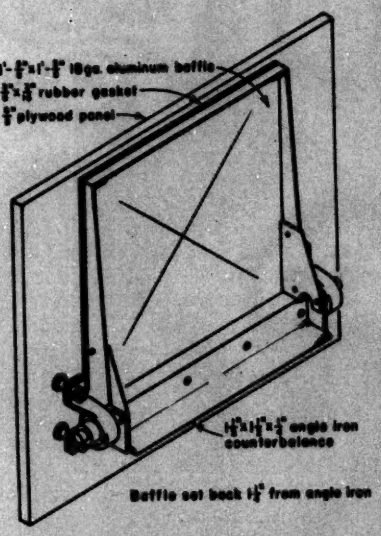

1'-8"x1'-8" 18ga. aluminum baffle
⅜"x⅜" rubber gasket
¾" plywood panel
1½"x1½"x⅛" angle iron counterbalance
Baffle set back 1½" from angle iron

Fig. 3—Design of baffle used over each fan in potato test. In tomato test the three baffles for each bulk-head were mounted on one panel.

The baffles as installed in the car are shown in Figs. 4 and 5.

Performance Tests

Thermostatic units as described above, as well as certain modifications, have been included in two accompanied transit tests originating in the Bakersfield, California, area.[1]

In a test with early potatoes, the following were compared:

(a) a car with baffles and with the fans controlled by a thermoswitch set at 55 F,
(b) same as above except with thermoswitch set at 45F, and
(c) a conventional fan car.

All cars were initially iced to half-stage capacity and re-iced at all regular icing stations en route under standard refrigeration service.

In an earlier test with mature-green tomatoes the following were compared:

(a) a car with baffles and with thermostatic control of all fans,
(b) a car without baffles but with thermostatic control of all fans,

(3) Barger, W. R., A. L. Ryall, and A. A. McKillop. 1956: Thermostatic control of fans in a refrigerator car of tomatoes. USDA, AMS-81.

(4) Barger, W. R. and A. A. McKillop. 1957: A. railway transportation test with California early potatoes. USDA, AMS-160.

[1]These tests were made possible through the cooperation of the following: Preco, Inc., The Santa Fe Railroad and its Refrigerator Department; and the shippers and receivers. Preco, Inc. rewound the relays and made necessary alterations in the electrical circuits of the cars. An additional test with lettuce, conducted since this article was written, was in cooperation with the Pacific Fruit Express Co.

(c) a car without baffles but with thermostatic control of the four corner fans leaving one fan operating normally in each end of the car, and
(d) a conventional fan car.

During the tomato test, the thermoswitch settings were changed en route, and consequently the results are of limited value. All four cars were initially iced to half-stage capacity and not re-iced except car (a) which received an additional 1500 lbs. of ice in each bunker at Belen, New Mexico, in order to test the thermostat control with excess bunker ice.

The results of these tests are presented here in brief, the details having been previously reported (3, 4).

Avoidance of low temperatures. The effectiveness of the thermostat in preventing low transit temperatures

Fig. 4—Control equipment installed prior to loading of potato test; baffles over fans are shown in open position. The second relay on the wall controlled an operations recorder used in test; the thermoswitch is not shown. (Photo courtesy Kern County Potato Growers Assn.).

Fig. 5—A test car of potatoes with baffles in closed position. The thermoswitch was inserted in the top center bag, foreground. The additional wires, not shown in Fig. 4, are leads to resistance thermometers located in the load to give temperature readings en route.

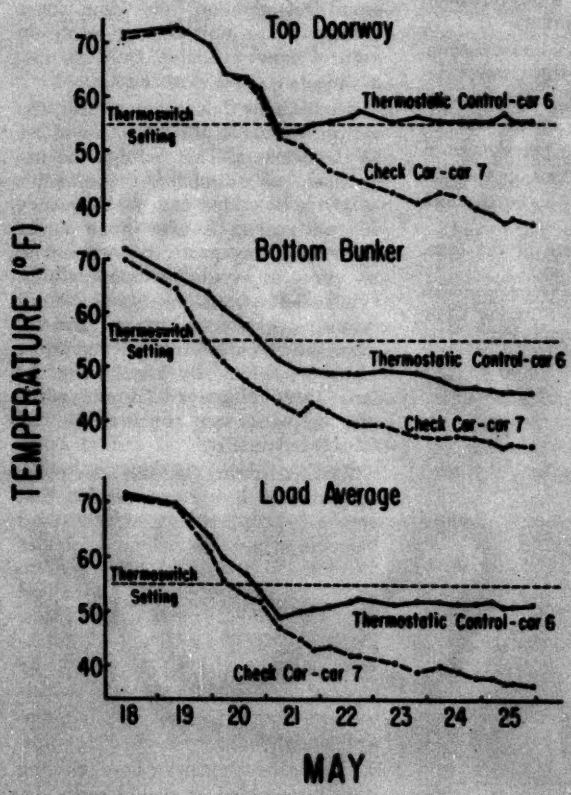


Fig. 6 (left)—The effect of thermostatic control of fans with self-closing baffles on transit temperatures of potatoes, Bakersfield, Calif., to New York City. Both cars were loaded with 360 100-lb. bags. The cars were initially iced to half-stage capacity at Bakersfield on the day after loading and re-iced according to standard refrigeration.

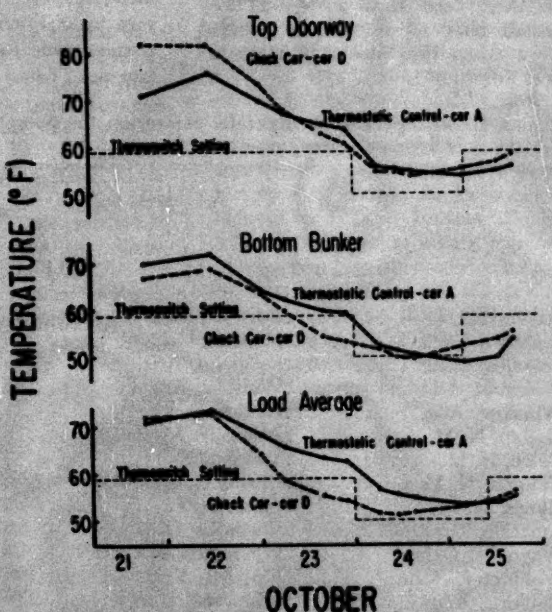


Fig. 7 (right)—The effect of thermostatic control of fans with self-closing baffles on transit temperatures of tomatoes bulk-packed in 60-lb. wirebound crates and loaded 399 crates per car. The cars were initially iced to half-stage capacity at Bakersfield. Car A (destination Nashville) received 1500 lbs. additional ice in each bunker at Belen, N. M.; Car D (destination Indianapolis) received no re-ice in transit.

when used with self-closing baffles was demonstrated in both tests. This result was especially striking in the case of the potato test where a thermostatically controlled car and a check car moved under half-stage, standard refrigeration (Fig. 6). The role of the thermostat in controlling air movement is reflected in the fact that the potatoes in a top doorway bag near the thermoswitch cooled to near the thermostat setting of 55 F and were maintained at this temperature. Although those in the bottom bunker position cooled to a temperature below that of the thermoswitch setting, they were definitely warmer than in a comparable position in the non-controlled fan car. Thus, serious cooling in the bottom layer did not occur during periods when the fans were not operating. The average temperatures of the load (12 positions) also demonstrate the functioning of the thermostat and baffles. However, the fact that the average load temperature was below that of the top layer (3 degrees lower) indicates that some cooling by convection did occur.

In the tomato test (Fig. 7), temperatures were in general warmer in the car with thermostat and baffles than in the regular fan car before the ice was depleted and even though the former received an additional 1500 lbs. of ice in each bunker. Both of these tests thus show that low transit temperatures can be avoided even when the bunkers contain excess ice.

Thermostatic control of all fans without use of baffles failed to prevent undesirable cooling in the bottom layer of the load by convection during long stops (3). Control of the four corner fans with the center fans operating independently of the thermostat and with no baffles moderated the temperature in all layers while the car was in motion (3).

Effect on cooling rate. With potatoes, operation of the thermostatic control did not retard the rate of initial cooling. With tomatoes, however, the rate of cooling was slower than in the conventional fan car. This occurred because the thermoswitch used in this instance could not be completely buried in the package, and it was therefore undesirably responsive to the air blast, causing the refrigeration to be switched on and off too frequently. The sensitivity and location of the thermoswitch are important in determining the rate of cooling of the load.

Uniformity of temperatures within load. In both tests there seemed to be a somewhat wider spread in load temperatures with thermostatic control. The range is not wide, however, and is not considered serious.

Fan operation and ice consumption. Another advantage of this control device is reduced power usage and ice meltage. The former effect can be seen by comparing the percentage of running time for the fans in the potato test (Table 1). With the thermoswitch completely buried in the load, there was very little cycling of the systems. The temperature came down to the thermoswitch setting, and only then did the control shut off.

Total ice meltage in the potato cars shipped under standard refrigeration was 13,200, 18,800, and 16,800 lbs. for thermostatic control at 55 F, control at 45 F, and no control, respectively. With comparable initial pulp temperatures, ice meltage was 3,600 lbs. less under control at 55 F than under no control. The higher meltage under control at 45 F is due largely to a higher initial pulp temperature in this car (an average of 10 degrees higher).

TABLE 1—The effect of thermostatic control on the operation time of the fans. All times are expressed as per cent of the running time.

Portion of Trip		Fan Operation Time as Per Cent Running Time* Car 5 45 F Setting	Car 6 55 F Setting
Bakersfield, Calif.	Barstow, Calif.	97	71
Barstow, Calif.	Needles, Calif.	64	72
Needles, Calif.	Seligman, Ariz.	98	94
Seligman, Ariz.	Winslow, Ariz.	85	78
Winslow, Ariz.	Gallup, N. M.	71	78
Gallup, N. M.	Belen, N. M.	78	88
Belen, N. M.	Vaughn, N. M.	83	0
Vaughn, N. M.	Clovis, N. M.	70	0
Clovis, N. M.	Amarillo, Tex.	92	0
Amarillo, Tex.	Waynoka, Okla.	88	0
Waynoka, Okla.	Wellington, Kans.	96	0
Wellington, Kans.	Emporia, Kans.	98	0
Emporia, Kans.	Argentine, Kans.	76	0
Argentine, Kans.	Marceline, Mo.	65	36
Marceline, Mo.	Shopton, Iowa	93	0
Shopton, Iowa	Chillicothe, Ill.	100	0
Chillicothe, Ill.	Chicago, Ill.	0	0
Chicago, Ill.	Logansport, Ind.	96	0
Logansport, Ind.	New York, N. Y.	10	0
For Entire Trip		57	27

* Based on time cars were traveling; check car = 100.

Discussion

The use of a thermostat to interrupt the operation of the electrical fans and baffles to retard natural circulation, as described above, shows promise as a method of controlling refrigeration in the electric fan-equipped RS-type car. This would improve the suitability of this car for fruits and vegetables requiring moderate refrigeration, providing at a relatively low unit cost, a means of control now available only in mechanical cars and in trucks.

Undesirably low temperatures can be prevented despite an excess of ice in the bunkers. This reduces the importance of estimating the amounts of ice to be added and the frequency of re-icing, as is now done under present railway protective services in an effort to avoid low temperatures. Controlled ice meltage should result in a saving of ice in transit and reduce the frequency of re-icing under many conditions. By inactivating the fans when refrigeration is not needed, motive power required for the train is reduced.

Further testing of this device is needed, and it is recommended that emphasis be placed on tomatoes and bananas to prevent chilling, potatoes to promote wound healing, and on lettuce to prevent freezing in salted cars. This system would seem to have particular application to pink tomatoes, which must be cooled rapidly to near 55 F and maintained at this temperature if ripening is to be controlled and chilling prevented in transit. In further testing where chilling is to be avoided, it would seem desirable to continue to limit the amount of ice added and to carry only relatively little in excess of anticipated needs.

(Continued on Page 52)

Hydraulic Drive For Transportation Refrigeration Offered in New Patent

AMONG new patents issued on refrigerating applications is one by Otto J. Schemmel, Chicago, Ill. which covers a hydraulic drive for refrigerating compressors. Schemmel's mechanism can be applied to certain makes of stock refrigeration compressors, while other developments of this inventor involve an entirely new idea of compact opposed piston reciprocating compressors, principally for transportation applications.

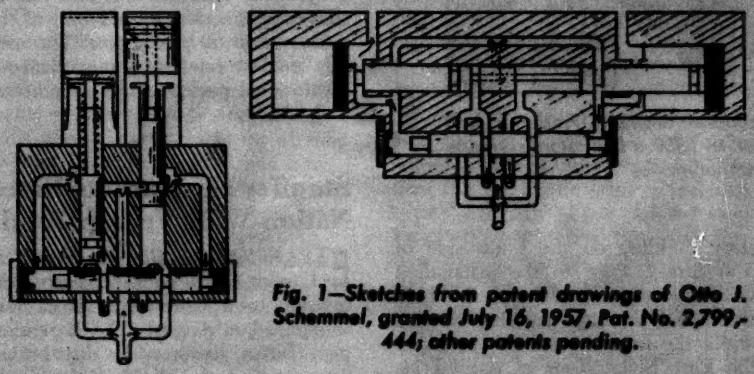


Fig. 1—Sketches from patent drawings of Otto J. Schemmel, granted July 16, 1957, Pat. No. 2,799,444; other patents pending.

Pictured at left in the patent drawing above (Fig. 1) the mechanism is applied to vertical single acting compressors for truck refrigeration. The device can also be applied to larger commercial sizes. Hydraulic fluid from a conventional pump driven by the automotive engine is transmitted to the mechanism.

As the fluid is transmitted from the pump, it exerts the pressure through the middle port, which pressure is maintained constantly when the pump is running. On either side of the middle port are two inlets and outlets for hydraulic fluid. Depending upon the position of a horizontal-acting cylindrical shuttle valve, the fluid moves first to a piston beneath one compressor cylinder. As the hydraulic piston moves under pressure, it compresses the gas in the refrigerant cylinder.

When the hydraulic piston has moved to the end of its travel, it opens a port which allows liquid from the middle constant-pressure port to be by-passed to one end of the shuttle valve. This moves the shuttle valve to its opposite position and admits pressure to the second hydraulic piston.

In the meantime, the shuttle valve has closed the inlet to the first piston and opened the outlet from same. The spring shown around the connecting round between the hydraulic and refrigerant pistons returns both to their original position. The hydraulic fluid is forced out of the first piston chamber and the refrigerant piston draws in suction gas during this operation.

Pictured above at right in Fig. 1 is the inventor's own adaptation of an opposed piston compressor which utilizes the same principle as described. The opposed piston model is shown in Fig. 2, the complete unit appearing at the left and the disassembled unit at the right. The cylindrical housing serves as a reservoir for the hydraulic system.

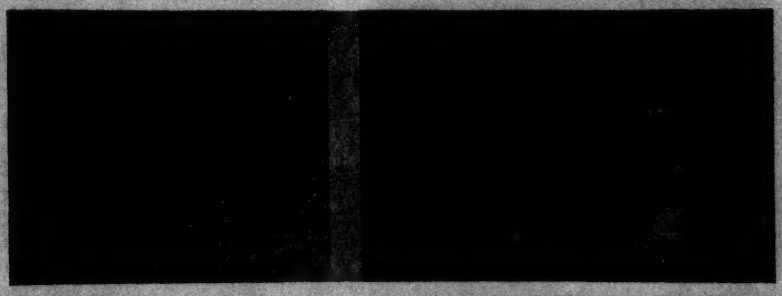


Fig. 2—Hydraulic driven opposed piston compressor invented by Otto J. Schemmel, Chicago. Complete working unit is shown at the left. At right the cylinder ends are pictured showing inlet and outlet for refrigerant gases, and the pump itself which is housed in the cylinder. Hydraulic inlet and outlet is accomplished through ports pictured on the cylinder wall. Unit is no larger than a household electric motor.

Biggest Refrigerating Machines Installed

THE two largest refrigerating machines ever installed for a commercial air conditioning system went into official operation recently with the opening of Eastland Center in Detroit. The Center is the second to be built in the Detroit suburbs by The J. L. Hudson Company department store. The big coolers chill water used in air conditioning all of the more than 70 stores. Cooling capacity of each unit is equivalent to the melting of 1900 tons of ice daily, according to Charles V. Fenn, vice president of Carrier Corporation, manufacturer of the machines.

As at Northland Center, first of the giant J. L. Hudson projects which opened three years ago, refrigerated water is circulated from a powerhouse through underground pipes to all stores. Some 10 million gallons will be pumped daily. Special meters record a combination of water flow and temperature from which the monthly charge is figured for each tenant. Each machine at Eastland has two 1,000 hp centrifugal compressors connected to the water chilling and refrigerant condensing assembly.

J. L. Hudson's downtown establishment has figured prominently in the history of centrifugal refrigerating machines. In 1924 it became the first department store to obtain this type of equipment for air conditioning after its development by the Carrier organization in the 1920's. Its current cooling plant which has 11 units totalling more than 5,000 tons of capacity is the largest store installation in the world.

Plan Big Coolers In Dallas Center

A 6,450-ton air-conditioning system, largest in the South or West, will be installed in the block-square, four-building Southland Center in the heart of downtown Dallas.

Among the features of the development will be an air-conditioning system of enclosed, air-conditioned walkways, which will connect the buildings at both second-story and basement levels.

New York Brewery Helped Pioneer Use of Refrigeration

The first brewery opened by the Schaefer brothers, Frederick and Maximilian, on Broadway at 19th Street. In 1858 a beer storage house replaced caverns and natural ice.

NOW located in Brooklyn adjacent to the Navy Yard in a modern brewery, the F. & M. Schaefer Brewing Company was among the brewers who pioneered the use of refrigeration equipment in this country. In 1858 the company erected one of the first beer storage houses to be constructed above the ground, a four-story building on the south side of 51st Street. Prior to the installation of refrigerating machinery, the beer was stored in huge lagering caverns under the brewery and the banks of the East River. Tons of natural ice packed on top of these caverns kept the brew at the necessary constant low temperature.

Freezing Invigorates Strawberry Plants

A NEW application for refrigeration in the horitcultural world is its use to infuse vigorous growth in strawberry plants. Strawberry runners taken from the beds in February and stored at below freezing for four months are growing strongly at the Scottish Horticultural Research Institute, Invergowrie, Dundee. The success of this experiment may lead to far-reaching changes in strawberry growing in both Scotland and England. The result of cold storing and planting in summer, is extremely strong plant growth. The few flowers formed by the plants will be removed, and by the autumn they will have two or three crowns. This should lead to an increase of crop in the first season from the cold-stored plants, compared with runners taken and planted in the autumn. More plants will be brought from the cold store at intervals until mid August. They are packed in polyethylene-lined boxes, and many hundreds are stored.—Modern Refrigeration.

Flexible Packages

THE advantages of preparing and reheating frozen prepared foods in flexible packages are significant economically and technically. Here are some of the advantages: Retention of flavor, protection of vitamins and minerals, control of shrinkage, confinement of odor, convenience to consumer.

Corn on the cob, carrots, turnips, other vegetable dishes, sauces, meat, poultry and fish specialties are types of food that benefit from this type of packaging.

Technical data on Mylar have been reported by H. Nagel and J. P. Wilkins of the DuPont Company. In mechanical, thermal and chemical properties and in resistance to moisture, bacteria and fungi and in tests for toxicity, Mylar appears to be highly satisfactory. Sealing has been a special problem because of its tolerance of heat. Use of a very hot wire or knife or of Benzyl alcohol or special adhesives indicates that this problem will be solved.—TRRF Bulletin.

Frozen Cherries New High

THE 1957 Frozen RSP Cherry pack reached an all time record of 130,888,750 pounds, according to a survey completed by the National Association of Frozen Food Packers. This compares with the previous record of 115.2 million pounds in 1953 and tops last year's 88.7 million pound pack by 47 per cent.

Packs in all regions were up this year, with that in the Midwest accounting for 66 per cent of the total. While back to something like the volume of recent years, the Northeastern pack amounted to only 29 per cent of the total, much less than its usual proportion. Tradition was followed in that approximately 95 per cent of the pack was in 30 pound tins. The usually modest retail and miscellaneous institutional pack remains proportionately the same.

Stouffer Restaurants Enter Nation-Wide Frozen Foods

EXPANSION of the Stouffer Restaurant Corp. cooked frozen food division to a nation-wide basis was announced in August. The expansion plan for a nation-wide distribution depends upon completion of the Stouffer modern frozen food plant in Cleveland. Current additions to the plant will increase production to 150,000 packages daily.

The announcement indicates that Stouffer intends to extend its frozen food distribution from Florida to Texas, and from St. Louis to San Francisco. Presently this division of the well known restaurant corporation distributes packaged frozen foods along the Eastern seaboard from Richmond, Virginia to Hartford, Conn. and westward to Chicago. (The story on Stouffers increased production facilities will appear in an early issue of INDUSTRIAL REFRIGERATION.)

New Frozen Food Package Pre-Cooked Dinner

THE frozen food industry has a new package in the works consisting of a pre-cooked frozen meal packed in a plastic pouch. "The bag has only to be dropped into boiling water for 15 minutes to produce a hot meal," according to Courtney Seabrook. He said dishes from fine restaurants in this country and abroad will be "bagged" for kitchen use.

Some of the specialties promised for fall distribution include Swedish meat balls in cream sauce, beef goulash, salisbury steak and lentil soup.

Materials Handling in Refrigerated Warehouse

A STUDY of materials handling by public refrigerated warehouses has been conducted by the Marketing Research Division of the United States Department of Agriculture. The objectives of this research were: (1) To determine the comparative efficiency of various types and combinations of materials-handling equipment for performing the different handling operations with representative types of containers in warehouses of single-story and multistory design; and (2) to determine the best practices in using the materials-handling equipment.

Time studies provided data on the elapsed time required for performing the various operations, and gave the total labor and equipment requirements of the methods and combinations of equipment, in terms of time and cost in materials-handling operations only. The costs of management and the warehouse structure were not included in these evaluations.

The study indicated that the forklift truck can reduce handling costs in multistory warehouses considerably, compared with the platform hand truck type of operation, when unit loads can be placed into storage without sacrificing too much storage space. However, other factors sometimes restrict the use of mechanical handling equipment in multistory warehouses. Some of these are: Structural limitations of the plants, types of commodities handled, and elevator capacity. In the single-story warehouse, forklift trucks are a necessity because the distance between the loading platform and storage point is usually beyond the limits within which a platform hand truck can be profitably employed, and manual labor cannot be used to advantage because of great stacking heights in the storage rooms. The study demonstrated that, on the basis of handling costs only, the single-story warehouse is considerably more efficient, as shown in the tabulation that follows, because elevators, which are essential in multistory warehouses, are not required.

Costs for handling carcass meat in both single-story and multistory warehouses were, without exception, higher than for any of the other commodity types stored. This finding was expected, but when the materials-handling operations were analyzed and the results tabulated, the large differential in costs became even more apparent.

Total costs per ton for each of the three materials-handling jobs (moving into, within, and out of storage) for each of the container types and methods observed in six selected public refrigerated warehouses were:

	Labor and equipment cost per ton			
	32-pound cans Dollars	32-pound cartons Dollars	101-pound bags Dollars	200-pound carcasses Dollars
Multistory warehouse				
Shipped by railroad car:				
1. Pallets, hand trucks, and industrial forklift trucks....	1.30	1.33	1.35	—
2. Pallets, hand trucks, walkie-type industrial high-lift trucks	1.34	1.35	1.39	—
3. Hand trucks	1.54	1.66	1.39	3.21
4. Hand trucks and walkie-type industrial tractors	1.62	1.73	—	—
5. Hand trucks and gravity roller conveyors	—	1.74	—	—
Shipped by highway trucks and trailers:				
1. Hand trucks	1.60	1.70	1.45	3.29
Single-story warehouse				
Shipped by railroad car:				
1. Pallets, semilive skids, jacks, industrial forklift trucks....	1.04	1.07	.95	—
2. Pallets and industrial forklift trucks	1.08	1.23	.88	2.18
Shipped by highway trucks and trailers:				
1. Pallets, semilive skids, jacks, and industrial forklift trucks	1.10	1.08	.92	2.39

Conference at UCLD On Indoor Climate Design

COMFORT control was the theme of an indoor climate designing conference or seminar offered by the Department of Engineering and Engineering Extension, University of California, Los Angeles on September 12 and 13. The conference held in cooperation with the Institute of Heating and Air Conditioning Industries included lectures on the following topics: "Man's Effort to Control His Environment"; "Characteristics and Meteorological Influences on the Climate of the Southwest Region"; "Man's Influence on Air Composition"; "Application of Climatic and Atmospheric Data to Design"; "Human Requirements for the Ideal Indoor Climate"; "Medical Significance of Air Contamination"; "Indoor Climate Desires for Family Living"; "Role of Building Design in Environmental Control"; "Static and Dynamic Methods of Environmental Control"; "Economics of Year 'Round Air Conditioning"; "The Indoor Climate of the Future: Its Challenge".

Harold P. Hayes, Dean of Engineering, California State Polytechnic College, who heads up the Question Box of INDUSTRIAL REFRIGERATION, presided over the third session held in the forenoon on September 13. Hayes was a member of the Industry Advisory Committee which worked with UCLA in sponsoring the seminar. Other presiding chairmen were: Leo Hungerford, General Conference Chairman, Director of Sales Engineering, Utility Appliance Corporation; Albert Bush, Associate Professor of Engineering, UCLA; Craig Taylor, Professor of Engineering, UCLA; F. W. Hutchinson, Professor of Mechanical Engineering, University of California, Berkeley.

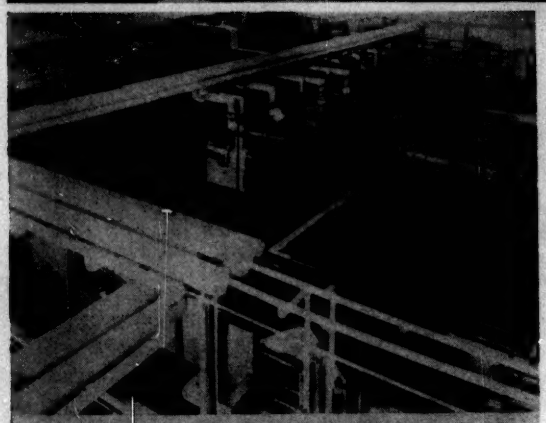
Large Attendance

With approximately 1,000 delegates attending, the conference dealt primarily with the problems and achievements involved in controlling the temperature, humidity, cleanliness and distribution of air indoors, both in home and industry.

Among the novel opinions that were revealed at the conference was one by Dr. L. P. Harrington of Yale University, who told the audience that the ideal temperature in the Garden of Eden was probably about 85 Degrees Fahrenheit. He called on the nation's builders to lead the way to climate design, declaring that thermal conditions may have a greater effect on shortening human life than hard work.

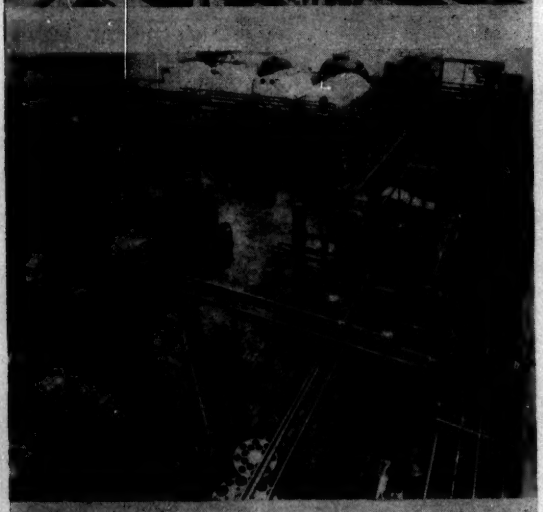
Carnation Engineered for

This liquid recirculating, multi-stage, compound plant produces multi-temperature levels for the Carnation Company Seattle Plant. Two rotary boosters, three high-speed multi-cylinder single-stage and two similar multi-cylinder high-stage compressors, plus seven liquid pumps, move NH₃ through its desired rounds.

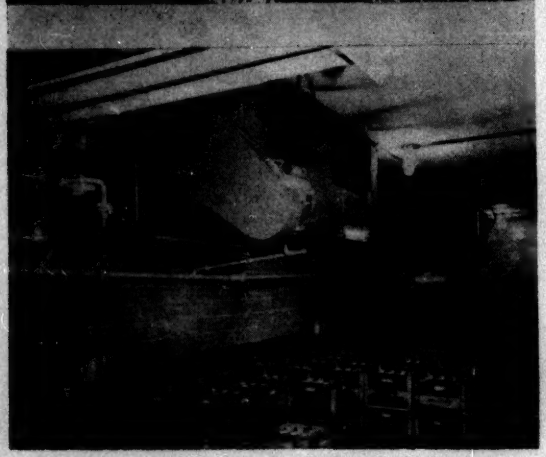


Ice cream mixes, cooling, pasteurizing vats, ice cream freezers and novelty production pictured in this ice cream products manufacturing room place heavy and varied demands on the refrigerating system.

Milk cooling, storing and pasteurizing as pictured in the process room, plus cheese manufacturing and all milk product cartoning, add more high temperature demands at peak refrigerating periods.



Peak high temperature requirements on the plant are made by this 300-ton refrigerated water tank involving the use of 48 York cooler plates. Recirculated ammonia removes process heat from the water which is stored for circulation during high demand peaks.

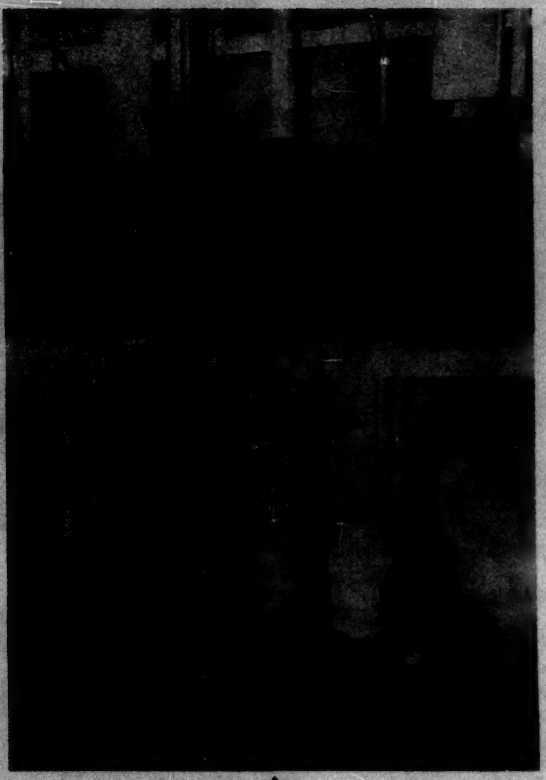


Storage of high temperature product requires additional refrigeration (66 tons) which is also handled by a liquid ammonia recirculating system at an intermediate temperature range. The ceiling hung ammonia blower units pictured are by Kramer Trenton Co.

*See *Industrial Refrigeration* Sept. '57, page 18, for a detailed description of the plant's construction, production and processing departments.

Seattle Plant* Top Efficiency

Low temperature suction (-35F) from the novelty tank, ice cream freezers, hardening and storage rooms (100 tons) is boosted to intermediate temperature and pressures by these two A-135 Fuller FES 75 hp rotary compressors.



Three low temperature receivers located behind the seven York ammonia recirculating pumps, are equipped with McKinnies' level controls. Liquid is supplied to the two low pressure vessels at the right, from the high pressure receiver. Sub-cooled liquid to the larger receiver at the left is supplied from the intermediate temperature vessel. The three pumps in the foreground supply liquid for the -35F system while the two pair of pumps at right supply the 12F and 30F systems.

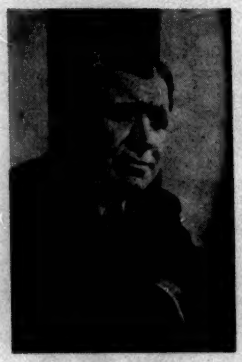
Two 150 hp York 8-cyl, model A589-2DE VW's, complete the high side or second stage compressor requirements. They take their suction from the intermediate system which supplies refrigeration for the two Pure-pak cartoning units and the high temperature refrigerated storages.

Chilled water cooling is accomplished by these two 125 hp York, 16-cyl, model A3169-5DE VW, compressors. A third compressor, partially seen in the left background is a similar 8-cyl. unit which gives added flexibility and meets low horsepower demands at off peak periods. Suction for these compressors is from the high temperature low pressure receiver.

Where is all the ammonia vapor condensed? Why here of course: Two Niagara Blower Corp. Model 2575, Aeropass condensers rated at 70 tons each, and four Model 2585 rated at 80 tons each, (all at 70 F wet bulb and 90 F condensing), provide flexible condensing media. Additional cooling towers lower the temperature of non-refrigerated cooling water used for initial milk and mix cooling.

All engineering, including drawings and specifications was handled by Carnation's own engineering department under the direction of John H. Forslew, assistant vice-president. Refrigeration contractor was the Ralph E. Manns Company of Los Angeles California.

NAII To Discuss Basic Problems At Detroit Convention



J. Lance Rumble

Ray R. Eppert

James W. Douthat

Four days of sound business discussion and profitable operating procedures is in store for those attending the 40th Annual Convention of the National Association of Ice Industries at the Statler Hotel in Detroit, November 12 through the 15th.

Besides a galaxy of prominent industry speakers whose successful business operations place them in a desirable position to discuss pertinent present day problems, speakers of national prominence well known in commerce and industry will provide a timely summation and inspirational conclusion at the Tuesday, Wednesday and Thursday sessions.

Key Note Speakers

Key noters who will participate in the NAII program include: James W. Douthat, Assistant Vice President of the National Association of Manufacturers; Jennings Randolph, Assistant to the President and Director of Public Relations of Capital Airlines; J. Lance Rumble, General Manager, General Motors Corp. (Canada); Ray R. Eppert, Executive Vice President, Burroughs Corp.

James W. Douthat of Washington, D.C., Assistant Vice President of the National Association of Manufacturers, who will speak at the Wednesday afternoon meeting has been observing the Washington scene at first-hand since 1929.

Jennings Randolph, Washington, D. C., Assistant to the President and Director of Public Relations of Capital Airlines and a former Member of the United States Congress, is nationally known as an outstanding industry leader and is acclaimed as one of America's most stimulating speakers.

J. Lance Rumble, Toronto, General Manager, General Motors, Truck Division, Canada, has served in many capacities in and out of the truck business. He enjoys selling motor trucks — whether it be small or large, whether a $50.00 used truck or his largest order for 2¾ million dollars.

Ray R. Eppert, New York City, after completing his education, worked for a time for the Denver Post in Denver, Colorado, and then became associated with the Park Hotel in Rock Springs, Wyoming, where he remained until he joined the Burroughs Corporation as a shipping clerk in 1921.

He became General Sales Manager in October, 1941, and five years later was named Vice President in charge of Marketing.

Summary of Convention Program

TUESDAY, November 12 — Presiding Officer, E. L. Gunn, Jr., NAII President
- A Look at Your Association, William T. Jobe, NAII Executive Vice President
- Dollars and Cents, George Steers, NAII Treasurer
- Is It Worth While? President Gunn
- Pass The Ammunition, E. K. Wellman, City Products Corp., Detroit

WEDNESDAY, November 13 — Presiding Officer, Richard C. Muckerman, NAII Vice President
- Car Icing: A Look at the Future, Jean Brunell, H. Brunell, Ltd., Montreal
- Productive Changes in Processing, J. M. Twomey, City Products Corp., Cincinnati
- The Washington Scene, James W. Douthat, Assistant Vice President, National Association of Manufacturers, Washington
- The Human Side of Business, Jennings Randolph, Assistant to the President, Capital Airlines, Washington

THURSDAY, November 14—Presiding Officer, Paul W. Easton, NAII Vice President
- How We Merchandise and Promote Ice
- In St. Petersburg, Florida, George W. Stovall, Jackson Ice Company,
- In Wilmington, Delaware, William M. Pauley, Diamond Ice & Coal Company, Wilmington, Delaware
- In Amarillo, Texas, Charles E. Lamka, Amarillo Ice Company
- In Detroit, Michigan, Walter J. Hintz, Borin Brothers, Inc., Discussion
- Back Talk From The Rumble Seat, J. Lance Rumble, General Manager, General Motors Truck Branch, Toronto, Canada

FRIDAY, November 15 — Presiding Officer, President Gunn
- Ice Ahead, John H. Glenn, Glenn Ice & Fuel Company, Beardstown, Illinois
- Forty Years In The Ice Business, Peter A. Buehrman, American Ice Company, New York, New York
- Minding Our Business, C. P. Austin, NAII Secretary
- Top Management's Problems and Tomorrow's Economy, Ray R. Eppert, Executive Vice President, Burroughs Corporation, Detroit, Michigan

ASRE Semi-Annual Meet

THE American Society of Refrigerating Engineers will hold its 44th semi-annual Meeting November 14-16 at the Shoreland Hotel in Chicago, Ill. Conferences and forums upon subjects of timely importance will be mingled on the program with technical sessions.

Central Plant Air Conditioning for Multi-room Buildings appears on the air conditioning conference agenda for the first time. Methods of using aluminum for both tube-in-sheet and tube-on-sheet practice will be covered by several speakers at the domestic refrigerator engineering conference. Frank discussion of infrequently reviewed aspects is expected at the food preservation conference, where representatives of government, the armed forces, packers and can manufacturers will speak freely.

There will be six forums candidly approaching such themes as refrigeration in candy manufacture, automatic operation of refrigerating plants, the part ASRE can play in industry to encourage interest in refrigerating

engineering education, problems of correct installation of residential air conditioning, and small truck refrigeration equipment.

There will be eight papers at the three technical sessions. Topics will be thermal conductivity apparatus for operation near room temperature, influences of insulation in moisture condensation aspects of a steel warehouse, greenhouse climate control, air cycle air conditioning of the B-47, a moisture indicating device for refrigerating systems, permeability of plastics films to Refrigerant 12, and removal of ice films.

Feature speaker at the Welcome Luncheon on November 14 will be President Alvin J. Blake of the Chicago Technical Societies Council.

J. R. Kelahan, technical editor of INDUSTRIAL REFRIGERATION heads the General Arrangements Committee.

TRRF Annual Meeting

THE annual meeting of The Refrigeration Research Foundation will be held at the Adolphus Hotel, Dallas, Texas, Thursday to Saturday, March 6 to 8, 1958, the week preceding the annual conventions of The American Warehousemen's Association and the National Association of Refrigerated Warehouses. The Scientific Advisory Council will meet Thursday and Friday, March 6 and 7. The membership meeting will be held Saturday and the Board of Governors' dinner will be held Saturday evening.

The program will be based on technical facts and factors that shape the future of refrigeration. Members of the warehousing industry are invited to suggest for discussion some specific problems that they consider important. All TRRF members are urged to attend.

AWA Annual Convention Dallas—March 10-13

THE 67th Annual Convention of the American Warehousemen's Association will be held at the Adolphus Hotel, Dallas, Texas, on March 10-13, it has been announced by AWA President Raymond King.

The two AWA divisions, National Association of Refrigerated Warehouses and the AWA Merchandise Division, will hold several general sessions, as well as conducting independent programs. Over 750 warehousemen from all parts of the country are expected to attend and notable speakers such as Elmer Wheeler and Joseph F. Leopold will address the group.

Following Texas tradition, the Convention will be big and bountiful with fresh approaches to problems and replete with modern ideas for company operation and for increased volume.

Among the many outstanding features will be a new program format, an Opening General Luncheon on Monday, March 10, honoring "First-Timers" of both AWA Divisions with the world-famous "Sell the Sizzle, Not the Steak" Elmer Wheeler as speaker, followed immediately by the opening session. Those who plan to attend are asked to bear this earlier opening in mind and make travel and hotel reservations accordingly.

There will also be a genuine Texas barbecue and those who attend will profit from the many business sessions especially designed for the fast-moving pace of today's distribution system.

TRRF Offers Prize For New Idea in Essay

A REFRIGERATED warehouseman, who prefers to remain anonymous, has made possible an annual prize of $100 for the best discussion by a junior member of the industry of an original idea or ideas pertaining to the present or future of the refrigerated warehousing industry. While the grammatical quality and logic of the essay will be judged, the essential basis for the prize will be the newness, soundness and practicability of the idea or ideas expressed about the refrigerated warehousing industry or any significant part of its potential service to the American public or warehouse customers.

The contest paper should not exceed 2,000 words in length. Three typed copies of the essay must be submitted and they must bear the name of the writer and the name and address of his company. The essay shall be a discussion dealing with any important aspect of the refrigerated warehousing business and with such suggestions or ideas for improvement or extension of the function and usefulness of refrigerated warehousing as the writer may wish to present.

The winner of the prize shall be selected by the donor of the award, the President of the Foundation and the Director. All essays entered in the contest shall become the property of the Foundation.

To be eligible, the contestant must meet the following qualifications:

1. He or she must be under 35 years of age.

2. He or she shall be a bona fide member of a refrigerated warehousing organization in the United States or Canada at the time the article is sent to the Foundation.

The 1957 contest is now open and contestants have until January 1, 1958 to prepare and send essays to: The Refrigeration Research Foundation, 12 North Meade Avenue, Colorado Springs, Colorado.

New Warehouse Announced For Iowa City

THE CONSTRUCTION of a large cold storage plant in Iowa City, Iowa was announced recently at a stockholders' meeting of Protein Blenders, Inc. The stockholders also approved issuance of $1,000,000 in five percent convertible bonds to provide additional working capital for the company.

The cold storage plant, to be completed before the end of the year by Frantz Construction Company, will be located on property adjacent to the Protein Blenders home office, north of Iowa City.

The new plant will be 350 feet long by 144 feet wide and will have inside storage height of 16 feet. It will have facilities for the daily production of 250,000 pounds of frozen oven-ready turkeys.

The new plant will contain eight large blast freezer tunnels where turkeys will be frozen at 40 degrees below zero. The cold will be driven through the tunnels at a velocity of 4,000 feet per minute. Seven carloads of turkeys can be frozen in the tunnels at one time.

"The plant will have a refrigeration capacity great enough to take care of the household needs of every house in the states of Nevada and Wyoming combined," according to G. Urban Kelly, Chairman of the Board. The building will be of tilt-up concrete slab construction.

Underground Storage Plant Adds Space

THE Inland Cold Storage Company which operates an underground refrigerated storage plant three miles west of Kansas City, Kans., has added 650,000 cubic feet of storage, making a total of four million cubic feet of freezer and cooler space. The new space provides the largest single room. It has temperature controlled to below-zero through refrigeration equipment and complete wall and perimeter insulation. Products handled at the underground storage include frozen foods of all kinds. An illustrated article on this plant was published in the November 1954 INDUSTRIAL REFRIGERATION.

New Rotary Compressor Incorporates Seal Refinements

LEO J. VIVIEN

SPACE is necessary but often costly in the installation of refrigeration and air conditioning units. Having that economic fact in mind, Alexander Blackman, member of Louisiana Chapter No. 2. NAPRE set about planning and designing a smaller size larger volume compressor. He selected the compressor as the component in a refrigerating system which could most logically be reduced in size; a fact borne out by the change-over of many manufacturers from VSA to multicylinder reciprocating machines. Blackman did not follow this trend by any attempt to improve reciprocating units. His compressor is a rotary type design. However, the internal mechanism is completely new and different from other rotary types in use.

The objective of the Blackman compressor is to reduce the size per tonnage in all units, especially commercial units. This compressor, according to its inventor will be less than

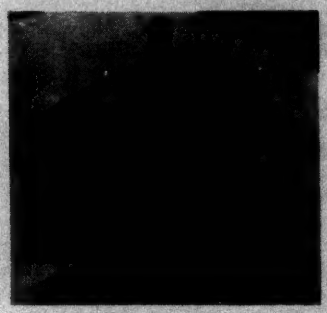


Fig. 1—Model of the Blackman rotary compressor. Alexander Blackman, a member of Louisiana Chapter No. 2, NAPRE, invented this pump.

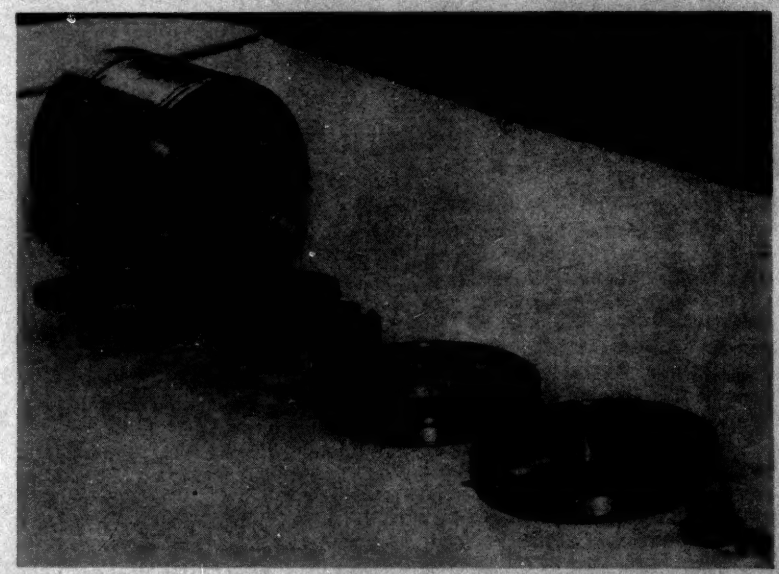


Fig. 2—Partially disassembled compressor pictured in Fig. 1. Shaft is held to center line of stator by end-bell at right. Offset rotor drives four working blades or vanes which are mounted on the cylindrical cam surface of the aforementioned shaft. Rotor effects a (pumping) reciprocating action on the blades as both turn about their respective axis. Eight half-cylindrical parts arranged in pairs about the vanes, seal the blade-to-rotor openings to prevent gas by-passing. Both sealing blades and cylindrical seals expand laterally to between rotor ends and stator closures.

Fig. 3—Exploded view of the Blackman rotary compressor. For simplicity, a number of sealing vanes and cylindrical gas seals have been omitted. Basic working vanes or blades make up the spider form at top center. Shaft protruding in Fig. 2 is the same pictured at top right in this view. Vane spider rotates on the cam cylinder on shaft, holding a concentric position within the stator. Rotor, slotted cylinder appearing below the vane spider, is the driver and actual pump for this type of rotary compressor.

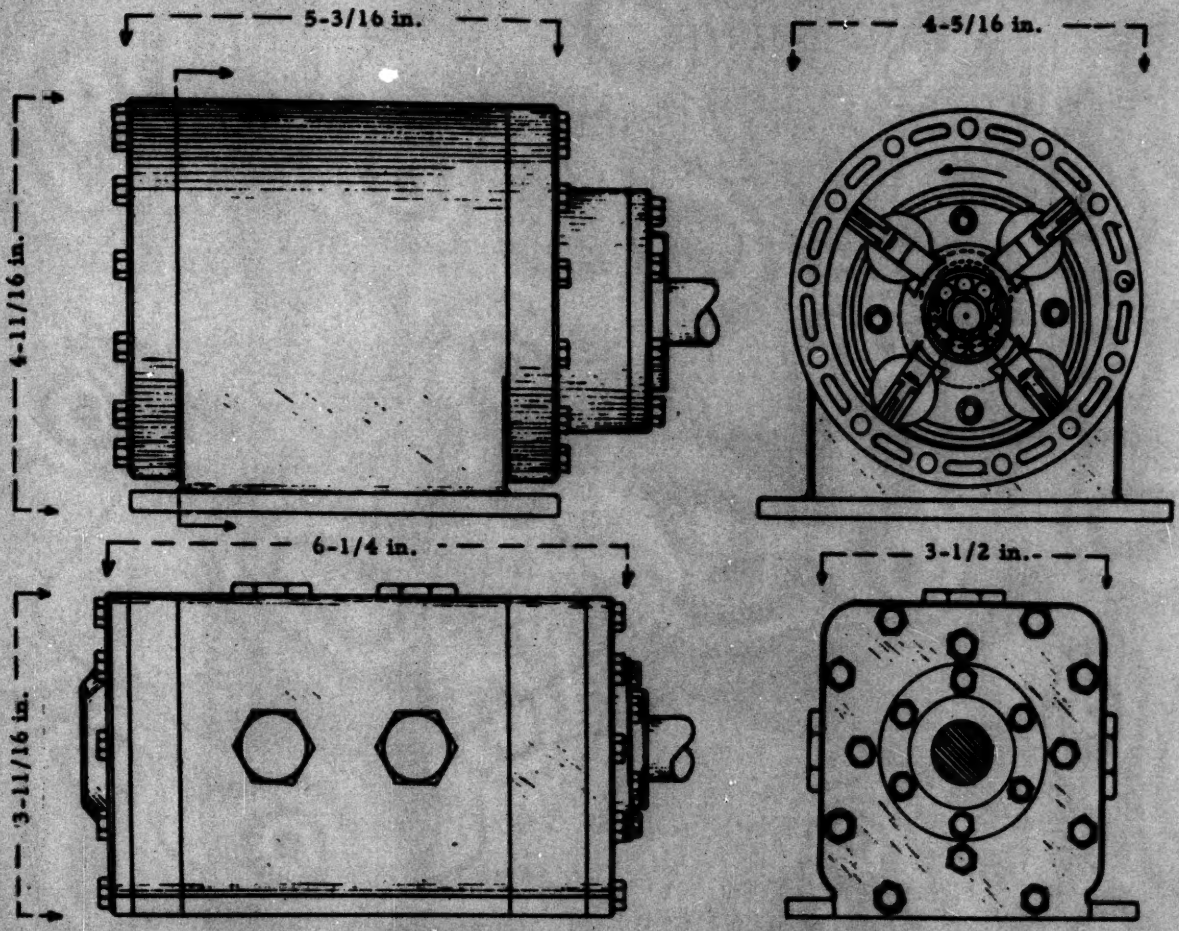


Fig. 4—Two models of the compressor which are specifically designed for automotive air cooling.

50 percent the size of other compressors which produce an equal amount of refrigeration effect. The manufacturing and maintenance cost will be cut considerably by the design itself.

Rotary Design Disadvantages

All rotary and centrifugal compressors are similar in one respect—working or pumping vanes or blades (also called the sealing blades) are mounted radially in narrow channels or slots in the rotor. Rotors are mounted at an eccentric position in the stator. The working blades or vanes wear round to the stator surface (where they belong) by centrifugal force to seal the pressure between blades and stator wall. But, they have no seals at all between rotor and end plates.

It is the inventor's experience that centrifugal force of the working blades is greater on some portion of the stator wall than it is on other portions, thus causing more wear where there is more pressure. Soon the stator wall is out of round, causing the blades to bounce, losing more pressure. Therefore, under such conditions of wear, 50 percent or more of the intake gas is bypassed in the compression chamber.

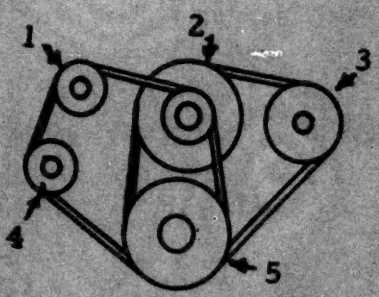


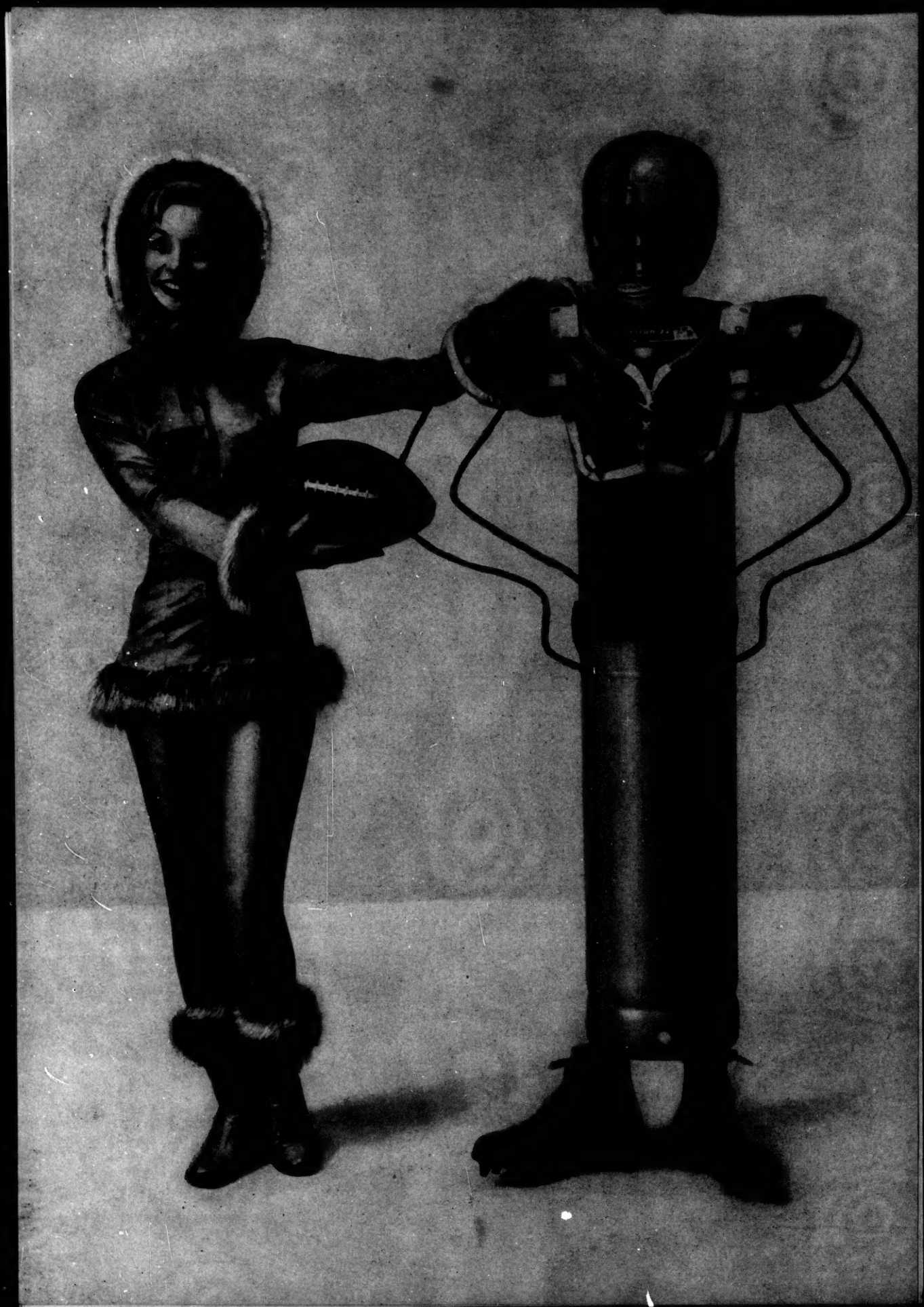
Fig. 5—Arrangement of a constant speed pulley for auto engine crank shaft, which it is said will drive refrigerant compressors and/or other auxiliaries at predetermined speed within a 300 rpm variation, regardless of motor speed. Pulley No. 1 drives the compressor; No. 2, the water pump and fan; No. 3, power steering pump; No. 4, generator; and No. 5 is the constant speed unit mounted on the crankshaft.

The New Rotary Described

In the Blackman compressor, as shown in Figs. 2, 3 and 4, the working blades or vanes are in two parts: the basic blades are mounted by bearings on a shaft in the center of the stator and they extend out to within a few thousandths of an inch of the stator wall. At the outer end of these blades are shallow slots or channels, and installed in these slots are smaller light sealing blades that expand both radially to stator wall and laterally to side walls by spring pressure. These sealing blades do not reciprocate on the basic blade; the basic blade and sealing blades rotating in perfect alignment to the stator wall and end plates. Having flat side surfaces and sharp sealing edges, the blades positively seal in the pressure.

In design, the basic blades or vanes

(Continued on Page 52)



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Dalton Asks Curtailment of Government Operation Of Refrigerated Warehouse Space

REFLECTING the interest and concern of many business executives in government spending, the following letter was sent recently by Wm. Dalton, secretary of the American Warehousemens Association:

The Hon. Charles E. Wilson,
Secretary of Defense
The Pentagon
Washington 25, D. C.

Dear Mr. Secretary:

In a recent Associated Press story, it was announced that the Navy was planning to put 30 ships, including the battleship Iowa and 26 other combat vessels, into moth balls soon to reduce expenses. This article also explained that these cuts came "in the wake of a Pentagon order to the Navy to reduce its personnel by 15,000 men, and to hold down spending".

For several years our industry has been trying to get Uncle Sam to reduce its gigantic operations in the storage field. You can understand very easily why we have been increasingly concerned—while reductions of Government competition have gone on all around us—because our own United States Government occupies more than 5¾ times the amount of storage space than exists in the entire public warehousing industry.

The "moth balling" technique has been used in many segments of Defense operative functions and activities. We have urged its use in as many of the warehousing functions of the Military as possible. We have also pointed out that a reduction in personnel is possible in such a project; that both a reduction of personnel and a reduction of spending would be the result.

Two recent pieces of information point up some startling reasons for our continued but immediate concern. They involve

(a) The fact that the Martin Company of Baltimore made recent inquiry of our Association's Merchandise Division concerning temperature controlled warehouse space. However, after our efforts resulted in the receipt of "sufficient information to negotiate a contract for space" for the Martin Company, the latter informed us they had found satisfactory space "within Government owned facilities"!

(b) It is our understanding that the Army is desirous of using Navy operated refrigerated warehousing space at Cheatham Annex, Virginia, for storing its commodities now being stored elsewhere in our Industry members' warehouses. If such moves continue to be made they would undoubtedly affect drastically the whole economic structure of Public Warehousing. This affect, in turn, is bound to have its own effect on the whole Military establishment who depend on this Industry so vitally during periods of both peacetime, and emergency, and especially the latter.

We are sure it will not be hard for you and your associates to understand why we have reached the point where our feelings, as substantial taxpayers, and our comparisons with other Industries who are enjoying well-justified Government de-competition, are disturbing.

Freezing Exempt from Tax

ELECTRICITY used by an Iowa cold storage concern for freezing foodstuffs was exempted as processing property and hence exempt from the state's two percent sales tax, said an Iowa Supreme Court ruling. Electricity used for storing the food after freezing was not exempt.

Refrigerant Leak Detector Helps Poisoning Diagnosis

PERSISTENCE by some engineers and maintenance personnel in the use of carbon-tetrachloride as a cleaning solvent may have been responsible for the continuation of research in detecting and diagnosing carbon-tetrachloride poisoning. Simply breathing vapors from this chemical still used in many consumer cleaning products and industrial solvents, can result in poisoning.

Medical-Engineering teams of General Electric Company's West Lynn, Mass. plant conducted investigations into the use of the firm's halogenated leak detector as a means of determining the presence of carbon-tetrachloride in the human system. According to Dr. J. W. Blevin, plant physician, other instruments have been used for such detection purposes, but none possessed the sensitivity and accuracy of the H-1 detector developed by the Instrument Department at West Lynn.

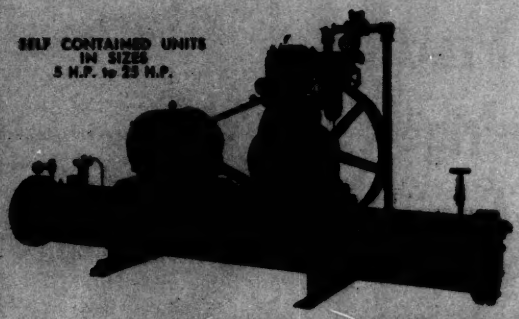
Carbon-tetrachloride poisoning, according to G.E.'s medical team, is four times as dangerous as carbon monoxide. In spite of Government, safety organizations, manufacturers and operating firms intensified campaigns to acquaint workers with the hazard, poisoning of this nature occurs frequently.

Dr. J. W. Blevins, plant physician, General Electric Co. uses the H-1 leak detector to determine the quantity of carbon-tetrachloride vapor inhaled by the patient. In this manner the diagnosis and treatment is expedited.

Applicable to Medical Uses

The supersensitive Halogen leak detector—an instrument used primarily to locate leaks in tightly sealed refrigerators and air conditioner units—can find a leak so small that only one ounce of gas would leak through the opening in 100 years. This, according to Dr. Blevins, has made the instrument applicable to medical uses and extremely valuable to the industrial hygienist for monitoring areas where toxic halogen gases may be used.

MODEL G-5 TONS TO 25 TONS CAPACITY



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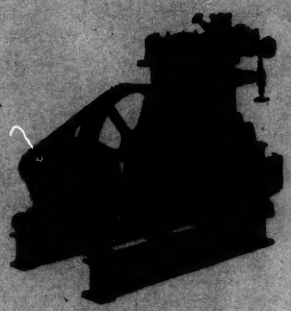

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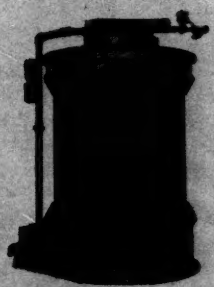

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Operating engineers of all refrigerating plants are invited to affiliate with the National Association of Practical Refrigerating Engineers, Inc., an educational association, "not-for-profit".

From the President's Desk

As this will be the last issue covering my term as president, I wish to take this opportunity to thank each member of NAPRE for support during the past year. It would be my pleasure to meet each of you here in Chicago at the National Convention so that I may thank you in person for the splendid accomplishments made during my term.

As in the past we have shown a terrific stride in acquiring new members for the Association. However, our conservation of members has been somewhat poor. We must review our practice of allowing a number of men to become disinterested after three to five year's membership. Apparently once they have finished the *Basic Refrigeration* course, a number of our members must feel that NAPRE has no more to offer them other than the monthly organ and the annual publication. This could possibly be more of a chapter responsibility than a national one. There may be something lacking in the local speaker program, the chapters may be failing to use the Question Box effectively, and in all probability they are not offering diversified services of interest to all their members.

The more successful chapters in recent years (of medium size), like Detroit, have excellent programs. They prepare a calendar one year in advance, publish it and stick to it. We know it is successful as we have watched this chapter gain steadily. The only few losses they have suffered have been through transfers or deaths. Recommended reading is the chapter report on the George B. Bright Chapter (Detroit) in next (Dec.) issue.

Publications

NAPRE has not gained in number of publications. As a matter of fact, publications of an educational nature this year were somewhat curtailed. However, the quality is much improved. Without a doubt the type of papers appearing under the Practical Engineer heading in our official organ have been truly operational in nature, or containing such material as to be of practical value in maintenance work. NAPRE has been commended for its work in this respect by such figures as H. B. Howe, President of Howe Ice Machine Company, A. A. Silverman, President of Vilter Manufacturing Co. Inc., the Sinclair Refining Company of Whiting, Indiana, and others. It will be the aim of NAPRE to continue this type of presentation in greater detail in our annual publication, the *Operating Data Book*.

Industry Relations

In addition to expanding our Industrial Membership (which new members will be introduced at the traditional Wednesday morning breakfast session, 48th Meeting, Del Prado Hotel, November 20), this important committee has promoted closer relationship between NAPRE and the major industries employing refrigeration in the United States. We have seen attempts between refrigerated warehousemen and ourselves to promote better safety in cold storage establishments. We have also received a pat on the back from some of the major operating companies in the hotel field for operating and maintenance aids to their engineers.

Education; Venemann Fund

Culmination of the year's educational activities, of course, is reflected in the coming educational sessions when 12 discussions are presented. Six of these presentations will relate to large industrial and commercial air conditioning. The other half will be on industrial refrigeration applications. These and other arrangements will be reviewed on another page of this publication. However, the program is one of the best arranged in years and members can best show their appreciation for national and local committee efforts by attending these affairs. Even if you have to take vacation time, it is well worth coming to Chicago for the 48th Annual Meeting.

A number of substantial contributions have been made to the student loan fund during 1957. Our Board of Directors is looking anxiously toward 1958, the year in which they intend to open the funds to first applications.

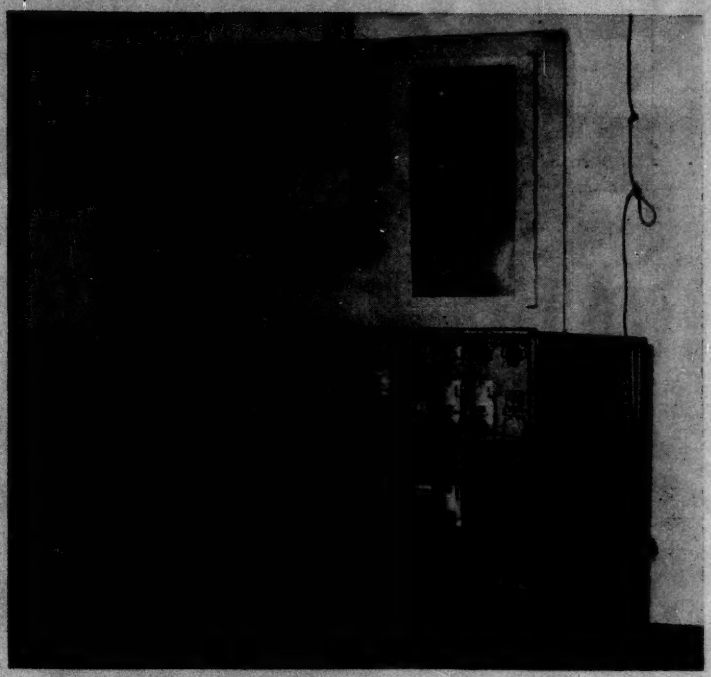
Best Reports

Of course the contest for the Best Reports in 1957 was closed with the October issue of IR. However the same contest will be repeated in 1958 and it is already my pleasure to report that the New York City chapter appears to have the best report of the month in this issue. Therefore they have first leg on the contest award for 1958. It is suggested that the other chapters review this new unit's work and get busy on reports of a similar nature which will reflect the activity of their own groups.

Bert C. McKenna

CONTROLS AT SOUTHDALE

HOWARD A. WOLFBERG
Guest Editor



Control panel for the Shopping Center's Gas Engine Heat Pump Prime Movers. Provision is made for sixth and final power unit.

LAST month a feature headline[1] in this publication emphasized the prediction by a refrigeration engineer that industrial establishments would be trading boilers for booster compressors in future plant heating applications. A month prior, an article on the place of heat pumps and solar energy[2] described how gas-driven compressors provided total heat requirements for an entire shopping center, the Southdale project near Minneapolis.

More such applications are coming fast, using earth, water and, predominantly, air as heat sinks. Most will be as near automatic as our present and future technology can make them. That involves more controls; controls for controls in some instances. Contrary to most popular beliefs, it will not eliminate the practical engineer. Instead, he will become more technical in background and training[3].

This prospect may frighten some "would-be" practical engineers. At least that was implied in the motor control article in the October "Practical Engineer" article[4]. It should not. Rather it should be a challenge; a contest to keep abreast, to keep informed, to improve technically, but by all means be practical. Purpose of this article then is to explain specific control applications and to show that their complex structures are really a vertical or horizontal arrangement of elementary systems.

The following article describes in detail the gas engine and refrigeration control systems for the Southdale Shopping Center. Wiring and control diagrams are utilized in this presentation, and for those who desire, they may be followed in detail. For those not following the diagrams in detail, it is intended that the general comments and the explanations of the diagrams will describe the functions and goals of the control systems.

Geographic Background

Southdale Shopping Center, located in Minneapolis, Minnesota, is affected by the severe winter and summer climatic conditions of this area. Heating, cooling and ventilating systems are dependent on the year around operation of its refrigeration plant. During the cold months of the year, this refrigeration plant operates as a heat pump, producing hot water for the entire heating requirements of the shopping center. During the warm months of the year, the plant operates as a refrigeration system only with a present capacity of

About This Feature . . .

Although Howard A. Wolfberg is an NAPRE member (Chicago Chapter) and author of similar works for NAPRE, he has not been an active member of the Association's Educational Committee. His vocation has been industrial refrigeration installations; his avocation, their controls. Out-of-town assignments and duty to family have been deterrent pre-occupations to national committee work. However, with the assistance and cooperation of *Industrial Refrigeration* (our official organ) in particular, and York Corp. Subsidiary of Borg-Warner, and their agency (the G. M. Basford Co.), NAPRE's Educational Committee is fortunate to have Wolfberg's services for these two (November and December) concluding articles to the 1957 educational series. Wolfberg is also featured on this topic at the November 18-21 NAPRE meeting, at Chicago's Del Prado.

Leroy Etsel,
Educational Director, NAPRE

[1] "From Boilers to Boosters" by Sydney M. Miner, INDUSTRIAL REFRIGERATION, October, Page 20.

[2] "Heat Pump and Solar Energy—Their Roles in Space Conditioning", by Prof. R. C. Jordan, INDUSTRIAL REFRIGERATION, September, Page 25.

[3] "Practical Engineer Trains for Associate Level" by Karl O. Werwath, Pres., Milwaukee School of Engineering, INDUSTRIAL REFRIGERATION, February, 1956, Page 31.

[4] "A Motor Control is Simple", by Educational Committee, NAPRE, INDUSTRIAL REFRIGERATION, October, Page 50.

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approximately 750 tons. An additional 1300 tons for air conditioning, required during maximum load conditions in the summer, is obtained directly from 50 degree well water and from package units located in the smaller stores of the shopping center.

Figs. 1 & 2—Top—Overall view from engine side of one (of five) compressing units at Southdale Shopping Center. Rectangular ducts are actually air supply plenums for carburetion. Bottom—closeup of VW compressor from opposite corner of compressor platform to that in Fig. 1. Discharge-to-suction by-passes and solenoids typical of each unit are visible at top of illustration. These function to completely unload the compressor during engine cranking.

The refrigeration plant represents the largest commercial heat pump installation ever built in this country. There are no boilers, auxiliary or otherwise, which are used for human comfort heating. Well water, at a temperature of 50F, is used as the source of heat during winter operation, and water at a higher temperature is used for the refrigeration condensers in the summer.

The refrigeration compressors are driven by internal combustion engines (See Fig. 1) and, in this respect, the refrigeration plant is unusual and unique. The system utilizes reciprocating compressors (See Fig. 2) with Refrigerant 12. Because of its large size, the overall design is similar to that of a single stage, brine or water cooling ammonia plant. One of the

major differences from the conventional ammonia plant is that automatic oil return from the evaporators to the compressors is achieved, and oil never has to be removed, replenished or rebalanced in the "Freon" system. Seal cap shutoff valves are used to minimize refrigerant loss, and the pipe sizing for some portions of the system is different from an ammonia plant of comparable size.

All of the refrigeration equipment was manufactured and installed by York Corp. Five 16 cylinder, 3-3/4 x 3 inches compressors discharge in parallel through two discharge line oil separators into a common header serving two 28 in. x 12 ft-0 in. condensers. A single 32 in. x 14 ft.-0 in. high pressure storage receiver receives the condensed refrigerant, and from here it is delivered through low pressure, liquid level controls to two 36 in. x 12 ft.-0 in., flooded type water chillers. A common suction main delivers the evaporated refrigerant from the water chillers to the five compressors.

Each compressor is rated 150 tons for air conditioning duty. At a future date the shopping center will be expanded, and a sixth compressor will be added to the refrigeration plant at that time.

Gas Engines

Natural gas internal combustion engines were selected instead of electric motors to drive the refrigeration compressors on the basis of decreased operating costs. In this case, the saving in energy charges more than offsets the increased maintenance costs for the engines. Natural gas fuel is furnished at a favorable rate for use on a shut-off basis. This means that the gas supplier can shut off the supply of fuel for several days at a time during the very cold weather. During these shut-off periods, the engines are supplied propane gas as a standby fuel.

Engines used at Southdale are Minneapolis-Moline model 1600-12A power units. Each of these power units consists of two six cylinder, 800 cubic inch displacement natural gas engines coupled together through a gear transmission to a common output drive shaft. The transmission is designed so that the common drive shaft rotates at a speed one and one-half times that of the engine crankshafts.

Each York compressor is directly connected to the drive shaft of a power unit and, since the engines have a maximum crankshaft speed of 1200 rpm, the compressors have a maximum crankshaft speed of 1800 rpm. A manually operated clutch permits each individual gas engine to be disconnected from the transmission. This permits each engine of a power unit to operate separately for service and inspection purposes, and permits this operation without the necessity of turning over the direct connected compressor. Each power unit is rated over 225 shaft bhp for continuous running operation, although the maximum connected compressor load is 160 bhp.

Automatic Controls

One of the most unusual and interesting aspects of the Southdale refrigeration system are the controls utilized to automatically start and stop each power unit and to vary the engine speeds as required by plant load. This operation is so automatic that the gas engines can be permitted to operate unattended for considerable periods of time.

The control system functions to maintain a constant temperature of the chilled water leaving the water coolers and could prove applicable for almost any large industrial refrigeration plant which utilizes gas engines to drive compressors. In such cases, suction pressure or brine temperature could easily be substituted as the controlled variable instead of the chilled water temperature.

Following portions of this article describe the gas engine and refrigeration system controls installed at Southdale. Some simplifications and a few additions or extensions to the Southdale controls will be included in the description in order that the controls can be more representative of a typical refrigeration plant.

As a word of caution: An automatic control system is not a substitute for proper equipment maintenance and inspections. The use of automatic engine controls makes most necessary regular inspections and careful maintenance on the engines and their accessories. For example, fouled spark plugs or magneto breaker points with an unsatisfactory gap could easily result in the inability of an engine to start automatically.

Starting Equipment

First consideration in the design of an automatic engine control system is to determine the type of starting to be used. The most generally used starting method is by direct current starter motors, such as those used exclusively in today's automobiles. This type of starting utilizes storage batteries to provide the large amounts of current required during the short durations of starter motor cranking. Another method, often used for heavy duty natural gas or diesel engines, is by air starting motors driven by compressed air. A third method is to use special alternating current starter motors. In any case, it should be up to the engine supplier to furnish and warrant a starter and starter drive mechanism which will permit satisfactory automatic operation.

Each of the power units at Southdale has two 12 volt, direct current starter motors, one being mounted on each engine of the dual unit. The storage batteries are charged by the use of automatic, voltage regulating trickle chargers or rectifiers and not by engine driven generators. The rectifiers enable the batteries to be constantly charged, even though an engine might not be in operation for a prolonged period of time. Rectifiers also have the advantage of requiring little or no maintenance, while engine driven generators need inspection and service at regular intervals.

Direct Current Power Distribution

At first, it was thought that a centrally located bank of batteries, fed by a single rectifier, could be utilized to provide the direct current for all the engine starters. Calculations showed that, with this arrangement, positive and negative copper wires or buses of excessive size would have to be installed from the battery bank to each power unit in an effort to prevent detrimental voltage drops during starting. A different and less expensive direct current power distribution system was finally devised, and this is shown in Fig. 3 (a).

Referring to this diagram, it will be seen that a battery is located close to each power unit. A battery cable connects the "hot" or negative terminal of each battery to a 4x1½x¼ in. copper terminal block mounted on the power unit (See Fig. 4). This terminal block is insulated from the engine blocks. The positive terminal of each battery is grounded through a battery cable bolted to one of the engine blocks of the power unit. Size No. 1 wire connects in parallel the copper terminal blocks of three of the power units and also connects in parallel the copper terminal blocks of the other two power units. The bolted ground connections of the power units are connected in parallel in a similar manner.

An automatic, two rate, 30 amp. capacity rectifier feeds direct current through No. 8 wires to the parallel circuit for the three power units, and two No. 8 wires from this same parallel circuit transmit direct current

power to the automatic gas engine control panel pictured on the title page. Another automatic, two rate rectifier of 20 amp. capacity feeds direct current through No. 10 wires to the parallel circuit for the other two power units.

A voltage sensing relay in each rectifier functions hourly to detect the voltage of the batteries. If the battery voltage is below a predetermined minimum, the voltage sensing relay will cause the batteries to be charged at a high rate, and this high rate of charge will continue until the battery voltage is brought up to normal. At all other times the batteries are subjected to a very low charge, equal to their natural burn-off rate. Note from Fig. 3 (a) that a separate set of No. 14 wires is brought out from the 30 amp. charger to one set of battery connections. This permits the voltage relay in the charger to sense true battery voltage, which it would not do otherwise because of the current drawn from the circuit to the gas engine control panel. This same situation does not exist for the 20 amp. charger as it has no continuous current draw from its circuit.

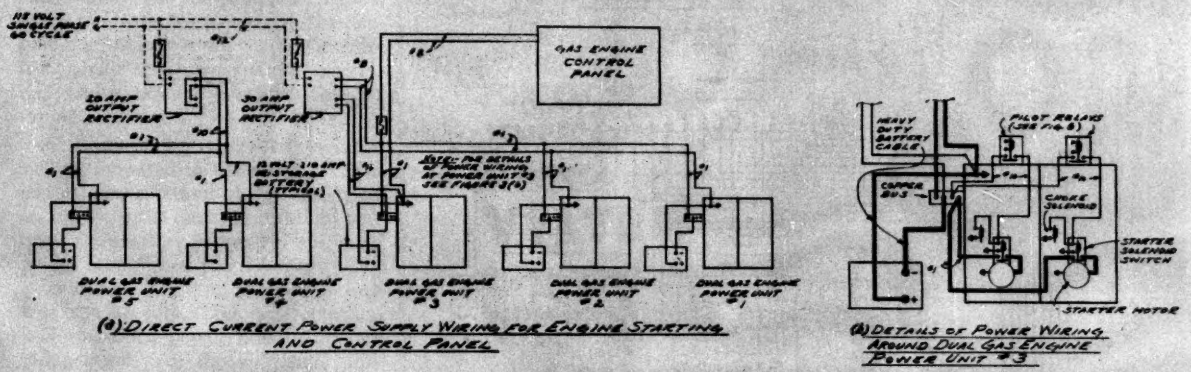
Design Advantages

The direct current power circuits described above offer several advantages. The No. 1 size wires which tie together the power unit battery connections are large enough to prevent any measureable voltage differences between batteries for the normal charging currents used. This means that the batteries will tend to quickly equalize under any condition. If one battery should be used repeatedly over a short period of time, (for example, in cranking over a power unit many times in rapid succession for service or inspection purposes), then its counter will drop to the point where the other batteries in the circuit will charge it. The rectifier will also charge this low battery if it is on a high charging rate at this time. Another advantage is that the battery closest to a power unit being cranked gets an assist from the other batteries in its parallel circuit. For example, each Southdale power unit draws approximately 720 amps during starting. Ammeter tests showed that the closest battery to a power unit supplies approximately 2/3 of this current and the other parallel batteries 1/3. These advantages mean that any one power unit can draw upon the resources of all batteries connected to its parallel circuit.

It should be apparent from the above that proper wire sizing for 12 volt power distribution is very important. The relatively large amounts of current required at this low voltage make necessary an analysis of wiring sizes to prevent undesireable voltage drops, particularly if long wiring runs are involved.

Power Wiring For Engine Starting

Fig. 3 (b) shows the direct current power wiring tied into the equipment on a typical power unit. The two pilot relays are simultaneously energized from the gas engine control panel whenever engine cranking is desired during an automatic starting sequence. When this occurs, the two solenoid starter switches and the two choke solenoids on the power unit are energized. The solenoid starter switches, when energized, cause the starter pinions to mesh with the engine flywheels and then close electrical contacts permitting the starter motors to crank the power


GAS ENGINE CONTROL PANEL
20 AMP OUTPUT RECTIFIER
20 AMP OUTPUT RECTIFIER
DUAL GAS ENGINE POWER UNIT #5
DUAL GAS ENGINE POWER UNIT #4
DUAL GAS ENGINE POWER UNIT #3
DUAL GAS ENGINE POWER UNIT #2
DUAL GAS ENGINE POWER UNIT #1
HEAVY DUTY BATTERY CABLE
PILOT RELAYS
COPPER BUS
CHOKE SOLENOID
STARTER SOLENOID SWITCH
STARTER MOTOR

(a) DIRECT CURRENT POWER SUPPLY WIRING FOR ENGINE STARTING AND CONTROL PANEL

(b) DETAILS OF POWER WIRING AROUND DUAL GAS ENGINE POWER UNIT #3

Fig. 3—Diagram (a) extending from left to center, pictures DC power supply wiring for engine starting and gas engine control panel. At right (b), is a detail of the power wiring around dual gas engine power unit No. 3 (center unit in (a) diagram).

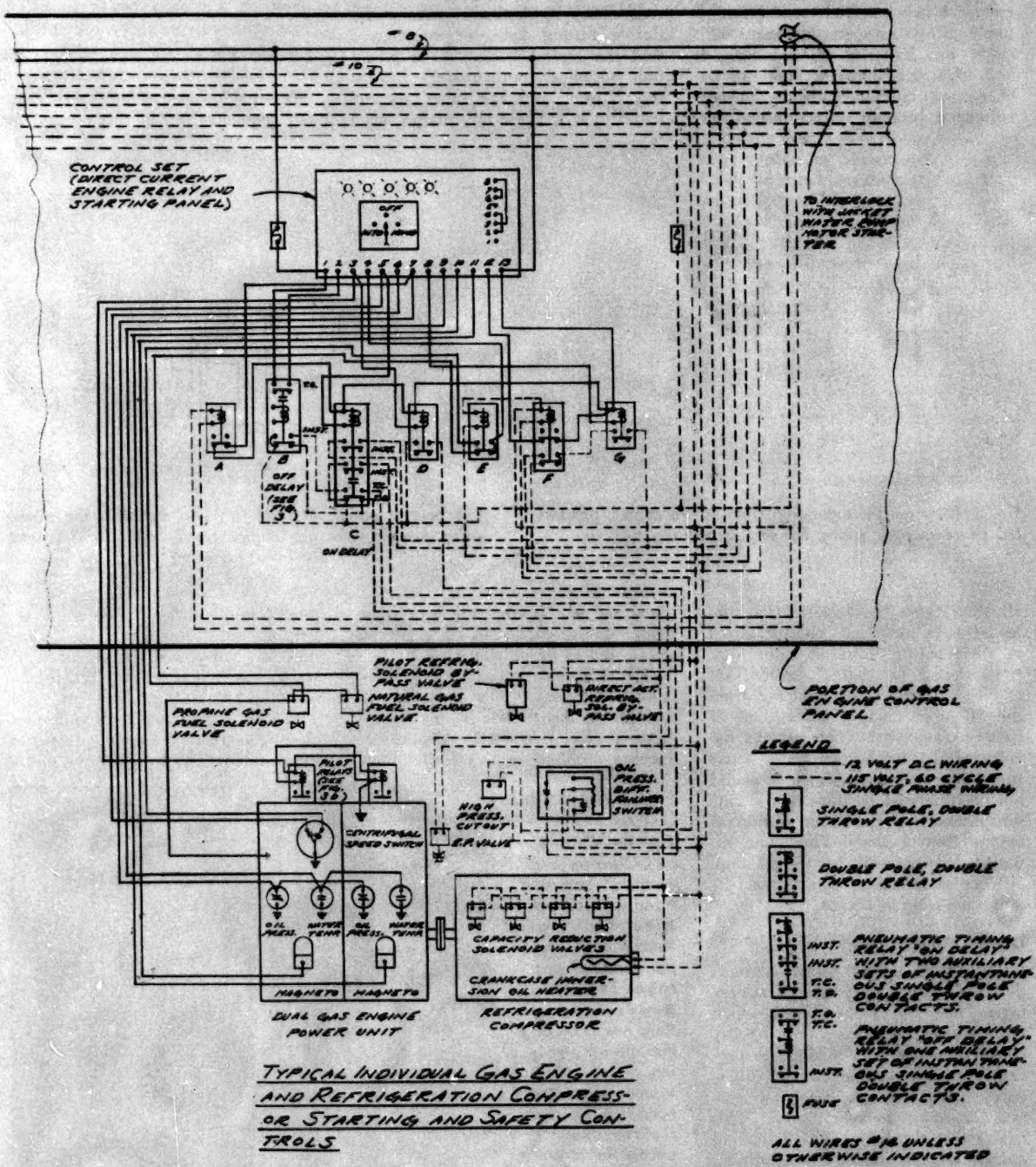
Fig. 4 — Close-up of DC power and control connections for gas engine starting. Heavy duty copper terminal strip takes incoming power connections and is on an insulated mounting. Pilot relays appear above the terminal block, starter switch above the starter motor, and choke solenoid beneath the carburetor.

unit. De-energizing the pilot relays drops out the automatic chokes and the starting switches, which stops the operation of the starter motors and disengages the starter pinions from the engine flywheels.

It should be noted that the choke solenoids, the starter solenoid switches and the starter motors draw current only from the parallel battery power circuit and not from the power panel. Therefore, the amount of current required by the power panel is kept to a minimum.

Control Sets

Heart of the engine and compressor control systems are Synchro-Start automatic control sets, one of which is used for each power unit and its connected compressor. These control sets are all mounted within the automatic gas engine control panel (See title page control illustration) and take their power from the 12 volt wires running between the parallel battery starting circuit and the con-


CONTROL SET (DIRECT CURRENT ENGINE RELAY AND STARTING PANEL)
TO INTERLOCK WITH JACKET WATER CIRC. MOTOR STARTER
PILOT REFRIG. SOLENOID BY-PASS VALVE
ANHYDRAL GAS FUEL SOLENOID VALVE
PROPANE GAS FUEL SOLENOID VALVE
DIRECT ACT. REFRIG. SOL. BY-PASS VALVE
PORTION OF GAS ENGINE CONTROL PANEL
HIGH PRESS. CUTOUT
E.P. VALVE
CENTRIFUGAL SPEED SWITCH
CAPACITY REDUCTION SOLENOID VALVES
CRANKCASE IMMERSION OIL HEATER
MAGNETO
MAGNETO
DUAL GAS ENGINE POWER UNIT
REFRIGERATION COMPRESSOR
LEGEND
12 VOLT D.C. WIRING
115 VOLT, 60 CYCLE SINGLE PHASE WIRING
SINGLE POLE, DOUBLE THROW RELAY
DOUBLE POLE, DOUBLE THROW RELAY
PNEUMATIC TIMING RELAY "ON DELAY" WITH TWO AUXILIARY SETS OF INSTANTANEOUS SINGLE POLE DOUBLE THROW CONTACTS.
PNEUMATIC TIMING RELAY "OFF DELAY" WITH ONE AUXILIARY SET OF INSTANTANEOUS SINGLE POLE DOUBLE THROW CONTACTS.
FUSE
ALL WIRES #16 UNLESS OTHERWISE INDICATED

TYPICAL INDIVIDUAL GAS ENGINE AND REFRIGERATION COMPRESSOR STARTING AND SAFETY CONTROLS

Fig. 5—Diagram of typical individual starting and safety controls for engine and refrigeration compressor. Synchro-Start control is shown as the rectangular unit, top center. These engine controls are pictured left and right behind glassed door enclosures of subject photo, title page. Relays A through G shown above, represent same equipment showing in opened portion of gas engine control panel, the title page subject photo.

trol panel. Fig. 5 shows one of these control sets, identified on the sketch as "DC Engine Relay and Starting Panel", mounted within the top portion of the gas engine control panel. Shown within the control panel, also in Fig. 5, are miscellaneous 12 volt D.C. and 115 volt A.C. relays which are located in the lower portion of the title page photo and are required to coordinate the individual control set with other engine and compressor control equipment.

Basically, each control set consists of an integrated group of 12 volt relays and bi-metallic thermal time delay units, all of which are internally wired and mounted and wired. Only the exterior covers of the engine control sets is shown in the subject photo and the interior relays, time delay units and wiring are not visible.

A hand-off-automatic selector switch, mounted in the cover of each control set, pictured at left and right at top of title page illustration permits a variation in control for each power unit. When this selector switch is in the off position, the power unit will not operate. The hand position will cause the power unit to operate independently of the automatic temperature control system. The automatic position will permit the power unit to operate only when it receives a signal from the temperature control system.

Also mounted in the cover of the control set are pilot lights. One or more of these lights will shine whenever the power unit is shut down by an engine or refrigeration system safety control which senses a dangerous operating condition.

Inlet-Outlet-Equalization On Compressor Shutdown

As previously mentioned, each power unit is directly connected to a refrigeration compressor, and the engine clutches are only used to disengage for service or inspection purposes. Under these conditions it is advantageous to reduce the compressor torque to a minimum at the beginning of a starting sequence. This will prevent engine cranking from being hindered. A small, direct acting solenoid valve, mounted close to the compressor between the discharge and suction lines (See again Fig. 4), equalizes the refrigerant pressure across the compressor during shut down.

Gas from the high side of the refrigeration system is prevented from bypassing through this solenoid valve by a refrigerant check valve mount-

The Tracy Ice and Development Company of Tracy, California, specializes in ice making and in providing cold storage facilities for fruit.

View of the Tracy engine room showing three of the four Vilter compressors. Vilter vertical shell and tube condensers and an evaporative condenser are also installed.

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The required storage temperature for the pears is 29° F., plus or minus 1° F. For the peaches the required temperature is 32° F., plus or minus 1° F. Conditions for the job also required that the peaches and pears must be chilled to the 32° F. or 29° F. point within a 24-hour period.

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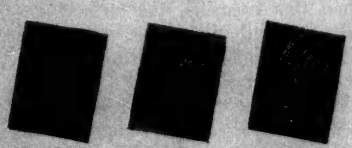
Write for these helpful bulletins to The Vilter Manufacturing Company, Dept. H-705, 2217 S. First Street, Milwaukee 7, Wisconsin.



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ed in the discharge line downstream from the by-passes. This small, direct acting bypass solenoid valve as shown in Fig. 4 is energized during compressor shut down through the normally closed, time delay contacts of Timing Relay shown in Fig. 5. The compressor capacity reduction solenoid valves and the compressor crankcase oil immersion heater are energized during shutdown through these same contacts of relay C.

Starting Sequences

Timing Relay B (See again Fig. 5) is energized by the automatic temperature control system after it determines that the operation of another refrigeration compressor is needed. With the selector switch in the automatic position, the closing of Relay B will permit current to flow to Terminal 2 of the control set, and this will initiate the engine and compressor starting sequences. When this happens, the natural gas fuel solenoid valve is energized through Terminal 4 and the normally closed contact of Relay E.

At the same time, the low tension circuits of the engine magnetos are ungrounded through relay contacts within the control set which are connected internally to Terminals 9 and 10. Ungrounding the magnetos permits ignition to take place.

Simultaneously, the two pilot relays on the power unit will be energized from Terminal 3. This will actuate the engine choke solenoids and starter solenoid switches, and the starter motors will begin cranking the power unit, as previously described.

The compressor capacity reduction solenoid valves and the direct acting refrigerant bypass solenoid valve are energized during the cranking period. However, when the capacity reduction solenoid valves are energized, the compressor is still capable of producing 25 percent of its capacity.

Unloaded Starting

In order to reduce this capacity to zero during the cranking cycle a second refrigerant bypass valve is used. This is a pilot operated solenoid valve, larger than the direct acting bypass solenoid valve previously described (See again Fig. 5). It is fully capable of equalizing the compressor discharge and suction pressures when the compressor is turning over during the cranking cycle. This pilot operated bypass valve is energized only when the power unit is actually cranking, since it is connected to the normally open contacts of relay D (Fig. 5), and this relay is connected in parallel to the pilot relays on the power unit. Thus, the power unit starter motors need only handle the compressor friction torque in addition to the engine starting torque. In this case, the compressor friction torque is very low at cranking speeds.

Cranking Termination

One of the most critical items in the successful application of automatic gas engine controls is the method used to terminate cranking. For engines with distributors, the frequency of breaker points can be used to operate a special relay to terminate cranking as the engine comes up in speed after firing. For engines with generators, the voltage buildup of the battery charging generator can be used to operate a relay to terminate cranking. Other methods which have found some use include fuel pressure buildup and manifold vacuum. However, there is no finer or more dependable method than the use of a speed sensitive switch. At Southdale, this last method is used, and a centrifugal speed switch accurately closes its contacts to terminate cranking after both engines of a power unit have fired.

A single, two element speed sensitive switch is mounted on each power unit (See Fig. 6). It was found convenient and practical to directly connect this switch to the water pump drive mechanism on one of the engines of each power unit. This was possible, since the engine driven water pumps had been removed in favor of independent electrically driven pumps. Normally, such a favorable condition does not exist, and the speed sensitive switches have to be driven through a flexible shaft or cog belt from a tachometer drive, distributor drive, or auxiliary drive shaft.

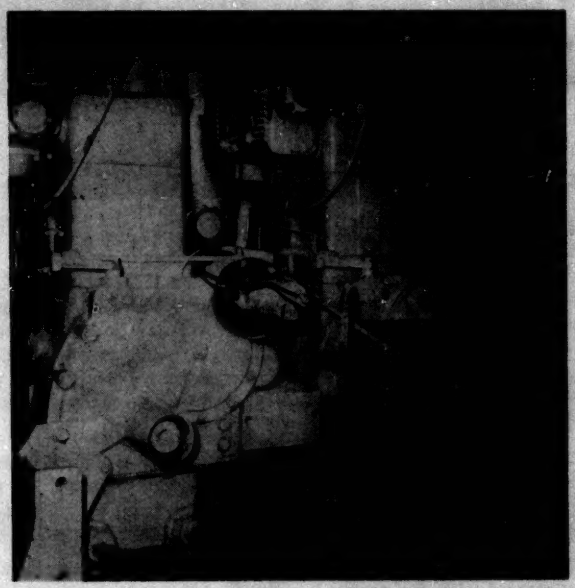


Fig. 6—Centrifugal speed switch mounted in lieu of water pump. Double setting switch serves both engines of the power unit, in the dual function of engine cranking termination and overspeed protection.

Fig. 7—Front view of a power unit showing jacket water pump and jacket water outlet from engines to pump. Exhaust piping from engines, appears behind and above jacket coolant lines. Lines at base of engines supplies hot water to and from heat exchanger type crankcase (oil) pans.

Referring again to Fig. 5, it will be seen that one of the elements of the speed sensitive switch is connected to Terminal 5 of the control set. As the engine begins to speed up after firing, this element will close its contacts, and both pilot relays on the power unit will be de-energized from Terminal 3 of the control set. Therefore, cranking will cease. At the same time, Timing Relay C will be energized, since it is also connected to Terminal 5 of the control set.

Idling At Start

De-energizing the E.P. valve shown in lower third, center area of Fig. 5 functions to position the engine governors to their idle speed setting. (More details on this specific operation will be given later). The E.P. valve is de-energized during shutdown and during engine cranking, since it is wired through the normally open time delay contacts of Relay C.

Relay C is energized when cranking is terminated, but its normally open time delay contacts do not close for approximately two minutes. Therefore, the power unit runs at an idle speed for the two minutes after cranking ceases. At the same time, the compressor capacity reduction solenoid valves and the small, direct acting bypass solenoid valve are still energized, since they are wired through the normally closed time delay contacts of Relay C. This results in the compressor running almost completely unloaded during the idling period, and the load on the power unit is extremely small.

After the two minute idling period, the E.P. valve is energized, and the compressor capacity reduction solenoid valves, the direct acting bypass valve, and the crankcase immersion oil heater are de-energized. The power unit then brings the compressor at full capacity up to the speed determined by the automatic temperature control system.

Idling in this manner prolongs engine life by permitting the oil circulation systems to start functioning when there is little load on the equipment and the engine speed is low.

Idling At Stop

An idling period with little compressor load for about two minutes is also provided at the time a power unit is automatically stopped. This operation tends to prolong engine life by preventing the overheating of valves, and by providing a more uniform cooling of the engine blocks and heads.

Idling at stop is accomplished through the action of Timing Relay B when it is de-energized by the automatic temperature control system. At this time, the instantaneous normally open contacts drop out, which de-energizes the E.P. valve and sets the engine governors to their idle position. Simultaneously, the instantaneous normally closed contacts complete a circuit to the compressor capacity reduction solenoid valves, the direct acting bypass valve, and the crankcase oil heater. Therefore, the power unit drives the compressor at virtually no load during this idling period.

The power unit operates for approximately two minutes at the idling speed until the normally open time delay contacts of Timing Relay B drop out. This results in grounding of the magnetos and closing of the fuel valve, and the power unit immediately comes to a halt.

Engine Safety Controls

Referring again to Fig. 5, note that a high temperature water safety switch and an oil pressure safety switch are mounted on each engine of the power unit. The water temperature switches are wired in parallel and connect to Terminal 7 of the control set. If the water temperature in either of the engine jackets should become abnormally high, the contacts in one of these water temperature safety switches will close, completing a circuit to the control set. This will immediately result in the grounding of the magnetos and the closing of the fuel valve, and the power unit will stop. At this time, a particular light in the cover of the control set will shine, indicating to an observer the exact cause of trouble.

The same arrangement is used for the oil pressure switches which connect to Terminal 6 of the control set. In this case, however, a time delay unit within the control set prevents the oil pressure switches from becoming effective until a few seconds after cranking is terminated during start-up. This enables the power unit to start from shutdown with zero oil pressure.

The purpose of the first element of the two element speed control switch has already been described. The second element connects to Terminal 11 of the control set, and it functions to close its contacts if the engine speeds should ever become abnormally high. In the case of an overspeed, the power unit will stop and the third signal light will shine.

Fourth safety control for the power unit is entirely self contained within the control set. If the engines do not fire after a predetermined time during the cranking period, a time delay sequence within the control set will shut the power unit down and cause the fourth pilot light to shine.

Jacket Water Safety

Jacket water circulation through each power unit is provided by a centrifugal water pump direct connected to an electric motor (see Fig. 7). The holding coil of Relay A (Fig. 5) is interlocked with the starter of the jacket water pump, and Relay A is energized only when the pump is in operation.

If the pump should ever cease to operate when the power unit is running, a circuit will be completed through the normally closed contacts of Relay A to Terminal 7 of the control set. The power unit will immediately come to a stop, and the pilot light which also is governed by the water high water temperature safety switches will be illuminated.

The action of any of the engine safety controls or the jacket water pump safety control during the operation of a power unit will cause Relay G to be energized. This, in turn, will permit a remote engine alarm to sound and register.

Compressor Safety Controls

A high pressure cutout and an oil pressure differential failure switch protect the compressor from abnormal operation. The compressor oil pressure switch contains a thermal timing unit which makes this control ineffective for a period of 45 seconds after cranking is terminated during start-up. This is accomplished by interlocking the timing unit through one of the normally open instantaneous sets of contacts of Timing Relay C. The time delay permits the power unit to start from shutdown with zero oil pressure in the compressor.

The safety contacts in the high pressure cutout and oil switch are wired in series and connect to the holding coil of Relay F. If either safety control senses an abnormal operating condition, its contacts will open and Relay F will drop out. A circuit will then be completed through a set of normally closed contacts of Relay F to Terminal 12 of the control set, and this will result in stoppage of the power unit and the lighting of the fifth pilot light in the cover of the control set.

Each of the two compressor safety controls is hand reset. The action

of either of these controls will cause Relay G to be energized at the same time Relay F is de-energized. This, in turn, will cause a remote compressor alarm to sound and register.

Resetting Safety Controls

The engine, jacket pump and compressor safety controls are effective when the power unit is running under either hand or automatic operation. The safety switches in the control set can be reset by moving the selector switch in the cover to the off position.

Fig. 8—Natural gas and propane gas fuel headers typical for each engine and power unit. Natural gas is the lower, larger line. Note strainers, solenoids and regulators in both headers.

Dual Fuel Arrangement

Earlier, mention was made that natural gas fuel is supplied to the power units on a shut-off basis. This makes necessary a standby fuel with sufficient storage capacity to operate the power units for the duration of a shut-off period. The standby fuel is propane. A remote, underground storage tank is used to store it in a liquid state. The necessary propane vaporizers are located in a small equipment house on the ground level close to the storage tank.

Natural gas is delivered to the power units at an approximate pressure of 5 in., water. Propane gas is supplied at a pressure slightly above this. Each engine of a power unit is equipped with two pressure regulators, one being piped with natural gas and the other with propane gas. These pressure regulators are linked together in such a manner that the propane gas regulator can open only when there is no pressure in the line feeding the natural gas regulator.

From the regulators, the natural gas and propane gas lines tee together before connecting to the engine carburetor. A special fitting is located in the propane gas line between the regulator and the tee connection. When an engine is running on propane gas, this fitting permits the correct amount of air to be aspirated into the propane to reduce its heating value to that of the natural gas fuel. This arrangement makes unnecessary any adjustment of carburetor settings when a switch between fuels is made.

A solenoid shut off valve is located in the natural gas line and the propane gas line feeding the engine pressure regulators of each power unit. (See Fig. 8). Fig. 5 shows these valves wired through the contacts of Relay E to Terminal 4 of the control set. If Relay E is de-energized, the natural gas fuel solenoid valve is connected to Terminal 4 through the relay's normally closed contacts, and the propane gas solenoid valve is disconnected from the circuit by the normally open contacts. Conversely, if Relay E is energized, the natural gas fuel solenoid valve is disconnected from the circuit and the propane gas solenoid valve is connected to Terminal 4. Thus, the selection of fuel to be used can be made from a remote location by controlling Relay E.

Speed Control

Governor control for engines driving compressors is a necessity for most refrigeration applications. A change in head pressure with no change in refrigeration requirements will result in a load variation on an engine and, if governor control is not used, the engine and compressor speed will change with this load variation. The use of compressor capacity controls will also vary the load on an engine, and a speed change will occur if a governor is not used. Either a mechanical type governor or a throttle control system utilizing speed feedback can be used to obtain a stable speed control for an engine.

Each engine of a power unit at Southdale has a mechanical governor which actuates a throttle or butterfly valve in the engine carburetor. The power shaft of a single, heavy duty, piston type pneumatic operator (motor), which is mounted on the power unit, connects through linkage (visible in Figs. 6 and 7) to the lever arms of both engine governors. The position of the governor lever arms at any one time establishes the speed of the power unit, since the governors actuate the carburetor butterfly valves to maintain this speed. Therefore, the position of the pneumatic motor power shaft determines the operating speed of a power unit.

Compressed air, at a pressure of 80 psi. is utilized to actuate the pneumatic motor. A pilot positioner is used with the motor, and this permits a pilot source of air, at a maximum pressure of 17 psi, to control the motor and accurately position its power shaft. Manual adjustments to the positioner permit a variation in the modulating range and set point of the pilot air pressure in relation to the full stroke of the motor's power shaft.

The positioner and the minimum governor lever arm settings are adjusted so that a 9 psi range in the pilot air pressure will vary the stroke of the pneumatic motor power shaft from its minimum to its maximum effective positions. In this case, the power shaft will be sufficiently withdrawn at a pilot pressure of 4 psi to position the governor lever arms so that the power unit will run at its minimum operating or idling speed.

At a maximum pilot pressure of 13 psi, the power shaft will be fully extended, and the power unit will run at its maximum operating speed. The speed of the power unit will vary roughly in proportion to the

pilot air pressure values between the 4 psi and 13 psi limits.

A recording pneumatic, direct acting temperature controller shown in the title page photo, varies the pilot air pressure in accordance with the water temperature discharging from the water coolers. As the temperature increases, the pilot pressure also increases, and the power unit runs faster to produce more refrigeration.

A three way E.P. solenoid valve is mounted in the branch or pilot air line to the pneumatic motor positioner. When this E.P. valve is de-energized, the pilot air is exhausted from the positioner, and the pilot pressure drops to zero. The power shaft of the pneumatic motor then withdraws and the power unit runs at its idling speed. This E.P. valve is the one mentioned earlier which is de-energized during the idle-start and idle-stop periods of power unit operation.

The speed at which the power units idle is the same as their minimum operating speed under load. This speed is sufficiently high to insure adequate oil pump pressure in the compressors and to minimize poor speed regulation in the mechanical governors. At Southdale the minimum compressor speed is about 750 rpm and the maximum speed is 1800 rpm.

(December issue of Industrial Refrigeration will see this control article by Wolfberg concluded. In that continuation, he covers group operation, liquid feed, group safeties, auto-temperature controls, sequence charging, remote controls, jacket water uses and control, and full transfer. A complete diagram of controls, engine and compressor for the five units will be a feature illustration).

Book Review

ASRE DATA BOOK, Tenth Edition, Published by American Society of Refrigerating Engineers. Illustrated. Price $10.00 postage paid. ($10.50 in foreign countries). For sale by Nickerson & Collins Co., Chicago.

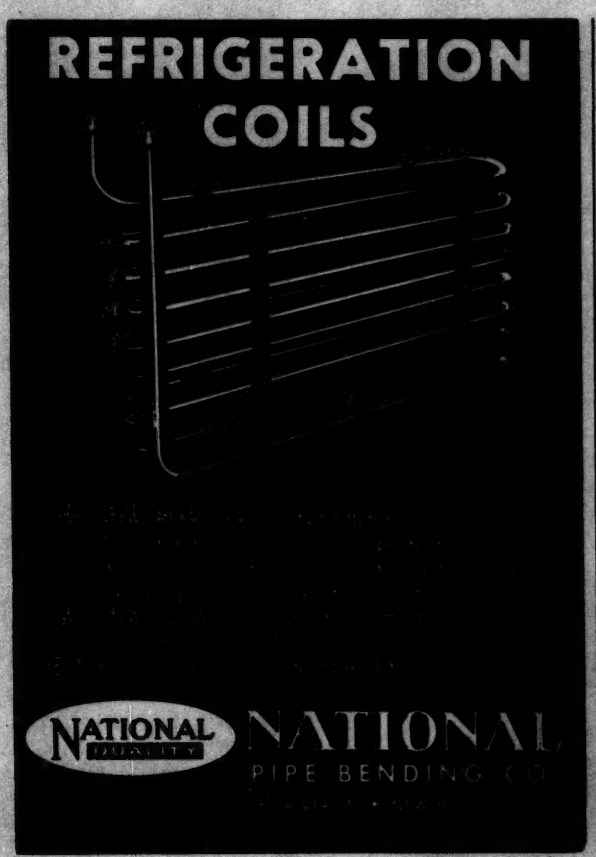
This 10th Edition of the Design Volume of the Air Conditioning-Refrigerating Data Book, official reference work of the American Society of Refrigerating Engineers, which has just been published is the well-recognized handbook of the air conditioning and refrigeration industry and is a fundamental tool for those active in design, research, reference, engineering, instruction, consultation and development.

Sponsored by 44 experts in the industry, the 10th Edition was written by eight Associate Editors, each selected for particular eminence in his field. This volume, 85 per cent revised, includes authoritative information on physical data, application design, basic equipment, auxiliary and self-contained units, operation, codes, standards, abbreviations, symbols, definitions, theory, engineering and refrigerants.

Each of the 39 chapters has been written specifically with design considerations in mind. The 800-page text is augmented by more than 400 charts and diagrams, plus 117 pages of charts and tables, to provide the fundamental facts upon which the companion Applications Volume is based.

Included for the first time are: English-to-Metric Conversion tables, a list of foreign and domestic air conditioning and refrigeration associations, the new ASRE industry-approved Refrigeration Numbering System, and cross-referenced listing of United States and foreign trade names for refrigerants linked with corresponding ASRE designations.

Providing an easy-to-use reference source, the Refrigeration Classified Section in the back of the text contains listings of manufacturers of components and assembled units of refrigeration equipment.



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Dual Programs Feature of 48th NAPRE Meet

DEPARTURE from many precedents will mark the 48th Annual Meeting of the National Association of Practical Refrigerating Engineers. The meeting will be held November 18 through 21 at the Hotels Del Prado and Sherry, Chicago, Illinois. In the educational sessions the association will feature dual speaker programs. Twin billings of this nature have not been undertaken by NAPRE before.

The convention will also recess daily at noon and encourage its members to attend the 10th Exposition of the Air Conditioning and Refrigeration Industry which will be held concurrently at the International Amphitheatre.

Association growth and meeting attendance, plus the wide variety of interests of Chicago this year have brought about the double-barreled educational sessions, according to Bert C. McKenna, national president. Where some precedents have been set aside, McKenna explained, others are being established. This is the first time the NAPRE has joined with any other group in a dual activity. NAPRE is happy to have had the opportunity to arrange their program in order to compliment the ARI undertaking at the All Industry Show, were the comments passed on by McKenna.

MONDAY, November, 18th

8:00 AM Registration
8:30 AM Exhibit Opening
9:30 AM Convene 48th Meeting
Presiding—Bert C. McKenna President
Invocation—Rev. Edward V. Cardinal, Pastor, St. Viator's Church, Chicago
Welcome—Hon. Carl A Schroeder, Postmaster, Chicago
Response—J. R. Watson, Hon orary Member
Reports—Officers and Committee Chairmen

AIR CONDITIONING CONFERENCE—Prado Room

11:00 AM "Problems of Hotel Air Conditioning"
Chairman, J. E. Scally, Vice-Pres., Alsonett Hotels

INDUSTRIAL REFRIGERATION—Park View Room

11:00 AM "Proper Refrigeration Increases Meat Profits"
Dan D. Wile, Recold Corp.
1:00 PM Field trip selections
2:00 PM 10th Exposition, ARI

TUESDAY, November 19th

8:30 AM Chapter Clinic
"Getting the Most from your NAPRE Publications"

AIR CONDITIONING SESSION—Prado Room

9:30 AM "Trouble Shooting on Refrigerant Flow Controls"
Wm. H. Krack, Sporlan Valve Co.
10:45 AM "Controls for the Modern Industrial Heat Pump Installation"
H. Wolfberg, York Corp., Subsidiary, Borg-Warner

INDUSTRIAL REFRIGERATION—Park View Room

9:30 AM "Multi-Staging of Refrigeration Systems"
Will F. Stoecker, Ass't Prof. of Refrigeration
University of Illinois
10:45 AM "Water Conservation Equipment"
J. Engalitcheff, Jr., Baltimore Aircoil Co., Inc.
1:00 PM Field Trip Selections

WEDNESDAY BREAKFAST SESSION

7:30 AM Presentation, New Industrial Memberships

SUSTAINING CLASSIFICATION

A. A. Silverman, Pres., Vilter Mfg. Co.
W. E. Kahlert, V-Pres., Baltimore Aircoil Co.
H. B. Howe, Pres., Howe Ice Machine Co.
H. Jarvis, Sales Prom. Mgr., Recold Corp.*

*Held Sponsoring Memb., 1956-7

CONTRIBUTING CLASSIFICATION

R. B. Bass, Sales Mgr., J. E. Watkins Co.
W. J. Merwin, Sec. Treas., Reilly-Benton Co. Inc.
G. A. Vieages, Sales Eng., Gabler Insulations
B. Nihlson, Owner, B. Nihlson Electric Co.
E. Henry, V-Pres., Hill Bros. Chemical Co.
W. H. Aubrey, V-Pres., Sales Mgr., Frick Co.
(Mrs.) A. C. Voss, Pres., J. H. H. Voss Co., Inc.

MEMBERSHIP AWARDS

E. A. Brandt Memorial Trophy
Large Chapter Trophy
Small Chapter Trophy

BEST CHAPTER REPORT AWARD

9:30 AM Chapter Clinic
"Establishment of Educ. and Speaker Programs"

AIR CONDITIONING SESSIONS—Prado Room

10:30 AM "Refrigeration and Air Conditioning Applic'ns In the Pharmacal Plant—Water Problems"
Paul V. Northam, Ch. Eng., Miles Laboratories

11:45 AM "Industrial Insulation of Piping and Pressure Vessels"
Dean Emerson, Jr., President, MMM, Inc.
INDUSTRIAL REFRIGERATION—Park View Room
10:30 AM "Centrifugals for Automatic Indus. Ice Mfg."
R. F. McKee, Mech. Eng., Pacific Fruit Exp. Co.
11:45 AM "Ammonia Recirculation in the Small Meat Freezing Plant"
Joseph Greenspahn, Ch. Eng., Frigidmeats, Inc.
1:30 PM Field Trip Selections

THURSDAY, November 21st

8:30 AM Chapter Clinic
"Membership Conservation and New Membership Promotion"
AIR CONDITIONING SESSIONS—Prado Room
9:30 AM "Basic Understanding of Air Cond'g Principles"
Norman Sharpe, Instructor, Calif. State Poly. College
INDUSTRIAL REFRIGERATION SESSIONS—Park View Room
9:30 AM "Refrigeration's Role in These United States"
Guy R. King, Instructor, Santa Monica Jr. College
11:00 AM FINAL BUSINESS SESSION
Presiding—Bert C. McKenna, President
REPORTS:
Chairman, Board of Directors
Finance Committee
By-Laws Committee
Resolutions Committee
Nominating Committee
BUSINESS:
Amendments to By-Laws
Adoption of Resolutions
Election of Officers, 1958
1:00 PM Field Trip Selections

SOCIAL PROGRAM

MONDAY, November 18th
6:00 PM Annual Informal—Sky Room, Sherry Hotel
Refreshments and Buffet
Entertainment:
TUESDAY, November 19th: OPEN
WEDNESDAY, November 20th
6:00 PM Inspection Visit
Atlas Brewing Co., Chicago
THURSDAY, November 21st
7:00 PM Annual Officers' Reception
Dinner and Installation, Dancing

Ladies Program

A complete program of events for the entertainment of the ladies of the convention has been arranged under the chairmanship of Mrs. William V. Richards, assisted by Mrs. Robert K. Howe, Mrs. Nicholas Downes, Mrs. Wm. J. O'Reilly and the ladies of Chicago Chapter.

Guided tours, a brunch and a luncheon at the Kungsholm which features the nationally renowned puppet opera will highlight the ladies entertainment program. The Museum of Science and Industry is easily accessible to the hotel for visiting during the convention.

Field trips are also in prominence in the NAPRE educational program. Two trips per day have been arranged for the 4-day sessions. In addition to the All Industry Show the Association has arranged for their members to attend the Museum of Science and Industry, a few blocks from the hotel on the south side of Chicago. Spotted close by will also be Fruit Growers Express Company Instruction and Training Car, FGEX-1600. This rolling classroom makes its second appearance at a NAPRE meeting, having been a feature of the 47th meeting at Detroit last year.

Highlight of the field trips will be a tour of the Experimental Boiling Water Reactor at Argonne Laboratory, Lemont, Illinois. This is the first full scale nuclear power plant developed by the U.S. Atomic Energy Commission. The plant generates 5,000 KW and is operated by the University of Chicago for the Government. Convention Chairman Nicholas M. Downes emphasizes the need for all convention attendants to make reservations for this field trip in advance. Anyone making the trip must be a U.S. citizen and able to produce proof of his citizenship.

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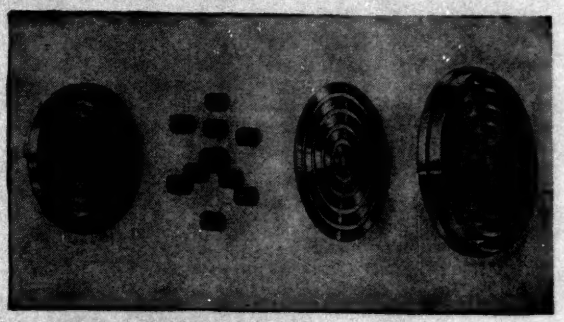

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Question Box

The National Educational Committee, NAPRE, answers monthly in this column, operating problems forwarded by members. The Committee appreciates answers from the field. Address questions and answers to Prof. Harold P. Hayes, Dean of Engineering, State Polytechnic College, San Luis Obispo, Calif.

Locating Leaks In Vertical Shell-and-Tube Condensers

QUESTION NO. 1203: Our plant is equipped with a bank of vertical shell and tube condensers of several different sizes. I suspect a leak in these condensers. How should I go about a test to see if I have a leak and how would I proceed to locate it?—M.R.H., N.Y.C.

ANSWER: If the leak is of appreciable size detection by a soap and water solution should be used at all joints. If the leak is small and the room is well ventilated so that there is no danger of explosion, sulfur candles may be used. When the ammonia comes in contact with the sulfur fumes a dense white smoke is formed.—N.S., San Luis Obispo.

Operating Steps When Receiver Glass Shows Clear

QUESTION NO. 1204: Picture a receiver in a sub-basement of an older hotel building—a hot humid congested area. What action should an operator take if the ammonia disappears out of the gauge glass. This happens frequently in warmer weather.—W.E.D., NYC.

ANSWER: Let us assume that the system has a gravity cooling tower and that the air circulation through the tower is poor. If such be the case the condensing pressure will be excessively high. With high pressure the system will hold more ammonia vapor, the ammonia may disappear out of the sight glass, and hence a greater refrigerant charge will be needed. If this analysis is correct I suggest that steps be taken to lower the condensing pressure such as the installation of an amply sized forced draft cooling tower.—N.S., San Luis Obispo.

Oil Substitution Effects

QUESTION NO. 1205: Please advise the effects 3050 oil (equivalent to SAE 20), would have if put in an ammonia refrigeration system where a Grade I oil should be used? The 3050 has a pour point of 0F, and has additives in same and is originally intended for medium duty motor sleeve bearings and fan bearings, while the Grade I oil is free of all additives and has a pour point of -25F.—A.G., San Francisco

ANSWER: It will be found that the majority of refrigerant producers, oil refiners, and equipment manufacturers recommend against using the type of oil in a refrigeration system which your associates propose. The 3050 oil does have a pour point of O F and would commonly be used for medium duty sleeve bearings and electric motors driving certain components in a refrigerating system. However, I do not believe it would be a wise practice to use it for the crankcases of your compressors.

Use only specially refined oils in refrigerating systems. The Texas Co. has published an excellent bulletin on Lubricants for Refrigeration Systems. A copy of this bulletin would be very valuable to you. The February 1951 issue of *Ice and Refrigeration* (now INDUSTRIAL REFRIGERATION) contains an article on refrigeration oils which should also be helpful to you. Write NAPRE headquarters or INDUSTRIAL REFRIGERATION for The Texas Co. Publication and/or the reprint mentioned.—H. P. Hayes.

Is Evaporative Cooling Considered Refrigeration?

QUESTION NO. 1206: Maybe you can help settle an argument for us. Who invented the first refrigeration machine? Can an evaporative cooler be classified as a refrigeration machine? I mean the typical home coolers used in the dry climates such as Texas.—A.D., Rio Grande Valley

ANSWER: You have asked two very interesting questions. I will answer them separately.

(1) The earliest recorded patent for a refrigeration machine was issued in Great Britain to Thomas Harris and John Long in 1790.

In 1834 Jacob Perkins, an American, patented a machine consisting of a hand operated compressor, a water cooled condenser, a weighted expansion valve and an evaporator in a liquid cooler. The unit was intended to use sulphuric ether as a refrigerant but never went beyond the experimental stage.

Dr. James Harrison of Australia also developed a sulphuric ether machine and in 1860 made the world's first installation of refrigerating equipment in a brewery. Other machines were subsequently developed by Harrison for the cooling of meats and other perishable products.

In the Spring of 1863 an anonymous author wrote as follows in the London Practical Mechanics Journal:

"One hundred years ago the notion of making ice by machine would have seemed as preposterous as an attempt to call down fire from Heaven; by the popular masses, even the most civilized in Europe, it would have been deemed an impossible but highly impious attempt to usurp or travesty the supposed but special powers of Deity alone; but to the best informed, the ice making would have seemed more impractical than even the calling down or diverting the lightnings of Heaven. The latter had, in fact, already been done."

(2) Your opinion on this question is probably as good as mine. I believe that an evaporative cooler can be classified as a refrigeration machine. Dictionaries do not list the compound term "refrigeration machine". However the separate words are defined.

"To refrigerate" means to make cold. "Cold" means of a relative low temperature. An evaporative cooler does lower the temperature of the air that passes through it below that of the atmosphere, particularly in arid regions. In this sense, it could be said to be a refrigerating machine.—N.S., San Luis Obispo.

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Where Is Efficiency Gained—Low Side, or High Side?

QUESTION NO. 1207: I am trying to improve the overall efficiency of our refrigeration plant. Should I concentrate on the high side or the low side? Or should I look toward the compressor or expansion valves as my best bet? Is there any one place where I stand the best chance to gain in efficiency?—B.C.M., Chicago

ANSWER: There is no one place in which to look for an improvement of efficiency. There are a few questions which may be asked however.

(1) Is the air circulation through the cooling tower good?

(2) Is the condensing temperature less than 35° above the wet-bulb temperature of the air?

(3) Is the evaporating temperature less than 15° below the temperature of the chilled fluid?

(4) Does the expansion valve keep the evaporator filled with liquid refrigerant?

If the answer to any of these questions is no, then a correction should be made to change the answer to an affirmative one.—N.S., San Luis Obispo.

What Methods Are Available For Rapid Produce Cooling?

QUESTION NO. 1208: We have been conducting tests and have found that rapid cooling of vegetables which are not immediately processed is to our advantage. We would appreciate your letting us know of any manufacturers or consultants who could help us with this problem.—B.E.B., New Jersey

ANSWER: Your tests are verifying those of other investigators who have proven that pre-cooling of vegetables as quickly as possible is advantageous from a quality viewpoint. The problems involved in pre-cooling can be classified in three categories:

1) Refrigeration: Pre-cooling may be accomplished by cold air, icing, or immersion in water. Any of the better known refrigeration companies such as Kramer-Trenton, Vilter, York, Recold, Vogt, and others could help you with data on refrigeration systems. Reader's Service Department of IR will be happy to provide you with a list of such firms.

2) Vacuum Cooling: Pre-cooling may also be accomplished by vacuum cooling, particularly in the case of leafy vegetables. The Gay Engineering Co. in Los Angeles could possibly help you on these problems. Several consulting engineers have had experience in this field. One of these is Edward Simons in San Francisco.

3) Materials Handling: Many of the problems in pre-cooling are essentially ones in materials handling. The Food Machinery and Chemical Co. in San Jose, Calif., has an excellent reputation in this field. So does the Link-Belt Co., which has offices in Chicago, Los Angeles, San Francisco and a number of other cities. The latter company has a 24-page booklet, No. 2382, covering the methods of icing perishable commodities in transit and storage. This booklet was reviewed briefly on page 55, September 1957, INDUSTRIAL REFRIGERATION.—H. P. Hayes.

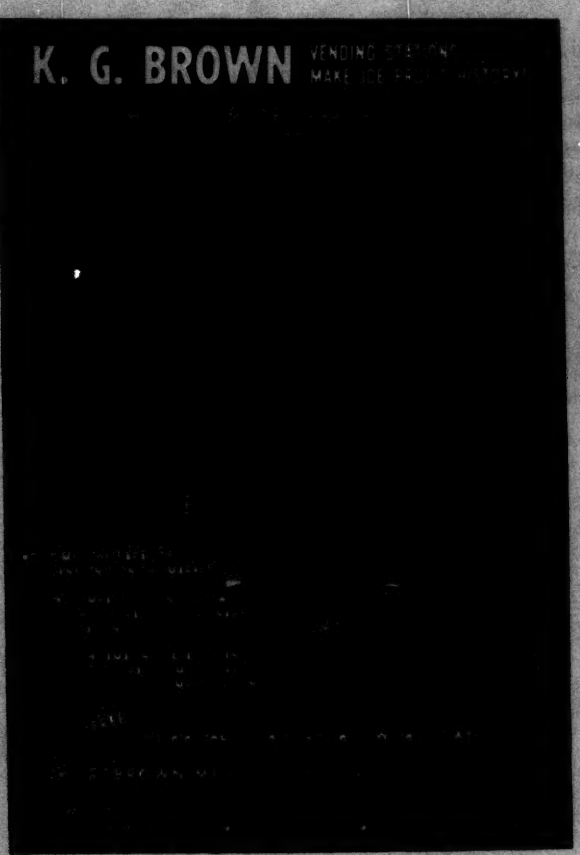
New Questions

Identity and Correction Asked for Slime Control

QUESTION NO. 1209: Gelatine like substance forms on air conditioning evaporator or builds up on drip pans located beneath evaporators in a hospital installation. The individual room coolers have a central (gravity) drip collecting system. This same substance clogs up the drip pipes.

Discussion at our NAPRE meetings brought out a presumption that the substance is an algae. Consensus was the treatment should consist of a hyperchloride solution which should destroy the algae. It was further agreed that the substance, if it is an algae should be completely destroyed and disposed of to avoid regrowth. Apparently this method becomes immune to some treatments and rebuilds.

Even after discussion of the chapter there is some uncertainty as to whether our guess-work is correct. Is there any printed literature or material available which would describe algae for us in



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order to compare it with our Gelatine substance? Are there any rather standardized treatments that could be described?—J. R. T., Jackson, Miss.

Wants "Why" Behind Certain A/C Suction Piping Practice

QUESTION NO. 1210: Why do some manufacturers put goose necks a few inches downstream of the thermal bulb on air conditioning coils?—G. B., Augusta.

Locate Best Charging Point

QUESTION NO. 1211: In some plants it is the practice to charge liquid ammonia direct into the main suction connection to the compressor while others charge through some portion of the evaporative system. Which is the better system?—E. E. C., Australia.

High and Low Voltage Effect On Motors, Plant Efficiency

QUESTION NO. 1212: What effect does high voltage have on the cost of electric current in a plant, say the plant is designed for 440 volts and that the current runs 480 to 490; also what effect will low voltage have?—E. D., Memphis.

How Molecular Weights Bear On Compressor Design, Uses

QUESTION NO. 1213: In October IR, page 13, there is a footnote which refers to NH_3 having a molecular weight of 17. Discussion at our chapter meeting showed that many of us did not understand why higher molecular weight had any bearing on the article. Could you answer this "why" in a few paragraphs in the Question Box? We think other chapters (and members) may not have understood the importance of that 17.—W. L. T., Chicago.

NH_3 Boil At Minus 28 F?

QUESTION NO. 1214: What is the temperature of liquid ammonia at sea level when held in an open container? Why is it at minus 42 F?—Q. M., NYC.

News Notes and Chapter Activities

DETROT—Members-at-Large from abroad do not often have the opportunity to visit their American refrigerating engineer counterparts in the United States. However, when they do, they are apparently received very well, if one can judge from the correspondence received by the National Vice President of NAPRE who is responsible for this membership category.

Recently William Engle, Manager of Refrigeration Engineering Company, Auckland, New Zealand visited the United States and in particular, Chicago, Ill. and York, Penna. Fortunately his visit was timed so that he could take in a Chicago Chapter NAPRE meeting. On his return to New Zealand, this is what he wrote:

"Safely returned after a most hectic two and a half months away from New Zealand. As I previously told the Chicago Chapter, this trip took me right around the world and it was quite a sensation to know that the world was really round, having personally proved it by flying eastwards from New Zealand and returning by the West.

"Now looking back over events, I feel in all sincerity that some of the most enjoyable hours of this two and a half months was spent in Chicago at the meetings of the NAPRE and the ASRE. Whether it is due to the fact that I have so much in common with those at both meetings, I do not know, but anyway it was good meeting you and I am looking forward to a steady growth of this friendship and if possible from time to time, further meetings.

"During my stay in Denmark, I had the opportunity of seeing a very interesting refrigeration installation of which I was able to make detailed notes and intend writing a paper on the whole job and letting you have it for ultimate publication in your official magazine, if you find it suitable. Besides that, I will write up various interesting installations here as soon as time permits and submit them to you for your approval with the same idea. Kindly pass on my good wishes to all the NAPRE Chicago boys."

About the time this communication was received from Engle, Bill Syme, Engineer for the Auckland Farmers Freezing Co. Ltd. wrote how pleased he was to learn that the NAPRE members were able to look after Engle and make his time so profitable. Needless to comment here, our Publications Committee has taken Engle up on his offer to describe the Denmark installation. It is hoped that we will have his manuscript for publication in INDUSTRIAL REFRIGERATION at an early date.

Not all news is always good news concerning Members-at-Large. The officers and members of NAPRE were sorry to learn late in August of the decease of Mrs. Agnes W. Fromberger, mother of NAPRE's good Member-at-Large, H. Spencer Fromberger of Charleston, So. Carolina. The sympathies of the association were extended to "From" by the national officers. Mrs. Fromberger was a pioneer of Daytona Beach.—R. T. BURNS.

Annual Watermelon Party Retirements at Memphis

OKRA CENTER—Tennessee Chapter No. 1 held its annual round-up of members and watermelon party at 8:00 P.M. on August 14 at the Midsouth Refrigerated Warehouse Co., across from the Fair Grounds. The weather had previously been unfavorable and caused some concern over the quality of the melons. However, grower Doug Smith, a chapter member, truthfully predicted that the melons would be the best yet. After samples, followed by second helpings, all in attendance agreed with Smith, that the other members missed a treat.

Two members of Tennessee Chapter No. 1 retired during the summer months. R. O. Clower, Sr., for 48 years with the steam electric plant in Memphis, retired at the compulsory age of 70. E. C. Kummerle also retired from the Frisco Railroad where he had been employed for 31 years. He is 74 years old.

Clower carried on the educational work of Tennessee Chapter for a number of years. According to officers at Memphis, he attends meetings more often than a lot of the younger members, maintaining that he always learned something new. He was superintendent of the steam electric plant now operated by the TVA. He held positions of chief electrician, assistant chief engineer and assistant plant superintendent prior to his most recent position.

Kummerle had served in the different offices of the chapter and was the chapter president for two years. Many NAPRE members will recall that he used to attend the national meetings regularly. Although he was chief engineer of the Frisco Railroad power plant in their Yale yards and shops, he had formerly been chief engineer of the Electric Ice Company for several years.

Taylor Instrument Program

Temperature Instruments was the principal topic of this Mid-south city's first September program speaker. Robert E. Paxson, field engineer of Taylor Instrument Company supplemented the chapter instructor in his presentation of Chapter 17 of the *Basic Refrigeration* text. Paxson had various types of thermometers with him and he explained the use of these various instruments.

The speaker also brought equipment to the meeting for measuring percentage of humidity. Each type of RH apparatus was explained and a demonstration was given on how to take the dewpoint. He was especially careful in his instructions to the members in the use of sling psychrometers. Paxson explained that the instrument must be kept away from the body and a steady swing must be used.

With the September 4 meeting, the chapter commenced its educational sessions once again and will continue to hold two educational meetings each month. On September 18, instructor Todd began the chapter on Compressor Calculations. Member M. C. Garner went to the blackboard and worked out the calculations as Todd described them. Together they worked out the capacity of a given compressor, the horsepower required, efficiency of the compressor, and showed how the compression ratio was obtained. The lecturer also included effective description of the effect on the horsepower and efficiency, of the compression ratio. Todd described a situation where a compressor was working on a very low suction pressure and used the same equipment in the second example of a high pressure suction. Members were indeed impressed.—CHAS. A. CONLEY.

Colton Studies Valves And Indicator Cards

SAN BERNARDINO—Instructor Frank Scherer lectured before the July meeting of California Chapter No. 5, Colton. Scherer continued his discussion of compressor valves and the differences in valve gear between the various makes of compressors. Following that discussion, Scherer discussed the use of indicator cards. Members were informed on how to go about making an indicator card on certain types of compressors and how to interpret the diagram which was recorded.

The August meeting of the chapter was an encore to a previous program by Frank Elliott and C. H. Purkiss. This program was the clinic type of presentation started earlier, entitled "What is Wrong With That Picture?" With Purkiss operating the slide projector and kibitzing Elliott's presentation, it turned out to be a very enjoyable second run. New problems were shown and a review of some of the more critical ones shown at the earlier performance were given. The repeat slides brought out the fact that many members still had missed or overlooked some of the mistakes. Therefore, the repetition was considered very well worth while.

Past chapter president and Mrs. L. G. Schroeder were hosts at their beautiful home on Grand Terrace, South of Colton, to the annual Colton Chapter picnic held on September 11. Over 75 members, their families and guests enjoyed a grand view of Colton and San Bernardino from the bluff which overlooks the valley some 300 feet below. Since the picnic was a late starting affair the attendants had a chance to enjoy a night view as well. The many colored lights of the valley cities presented an entrancing view—H. Bonter

National Vice President Visits Mississippi NAPRE

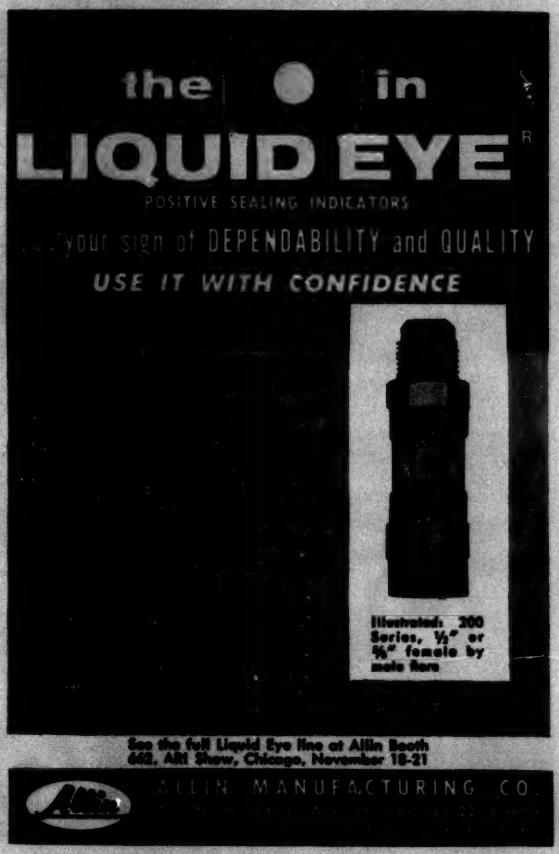
Jackson—Guest of honor at the August 20 meeting of Mississippi Chapter No. 1, NAPRE, was Frank L. Chase, national 1st vice-president and a member of New Orleans, La. chapter. Vice-president Chase had motored to Jackson to render another assist in the organization of this Mississippi chapter and to make tentative arrangements for the charter presentation. October 19 has been selected as the date for the charter presentation which will be made at a dinner meeting. (A complete report on the presentation, with illustrations, will appear in the December issue of IR).

Another guest of the chapter at the August meeting was George Nelson, executive secretary, Jackson Association of Master Plumbers. The purpose of Mr. Nelson's visit was to determine whether or not the local chapter would be interested in a speaker on a proposed air-conditioning, heating and ventilating code for the City of Jackson. Members went on record as inviting Mr. Nelson to return himself as the featured speaker on this topic, which he did on September 3.

Convention Delegate Appointed

Mississippi Chapter takes its part in the national scheme of things very seriously in designating October 19 as the date for the charter presentation. The chapter members do so knowing that presentation prior to convention would give them a vote equivalent to their membership strength at the coming Fall meeting in Chicago. Further, the chapter decided not to let any grass grow under its feet and through due process authorized Fredie Burdine as the chapter delegate, and it is hoped that the chapter will have other members in attendance at Chicago and these parties, will be designated as alternates.

First educational program for the chapter was presented by Educational Chairman Charles E. Warwick. All in attendance agreed his first effort was very successful. The program was centered on the first chapter of Basic Refrigeration, with explanation and illustrations by the instructor and question and answer participation by the membership. The question came up on algae which was dealt with by those in attendance. However, because of the newness of the chapter, the question has been referred to the national educational committee in the hope that more information can be collected on this troublesome problem in our industry here at Jackson.—J. R. Thompson.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Chapter Snowballs In Metropolitan New York

MANHATTAN, NEW YORK—August was certainly a warm month in New York City, but the chapter organization activities snowballed in spite of the temperature. The scene of the meeting was the Sheraton-McAlpin Hotel. In addition to the committee of 10 who are reviving the Greater Metropolitan New York area chapter, 15 other members were present and another dozen prospects were accounted for. Robert Lewis and Joe McNerney, two old NAPRE members, but new faces among the recent participants, were given a warm welcome. John Pondish and Bill Maher, both Members-at-Large for a number of years, transferred into the chapter at this meeting. The two latter members sponsored new members Joe Bakey and Walter Schmeis.

A distinguished visitor who proved to be the speaker of the evening was Charles Larsen, a member at present of the California Chapter No. 2 at Los Angeles. Larsen had previously been a member of New Orleans Chapter, and was transferred from Los Angeles to New York for some construction work on the Sheraton-McAlpin Hotel. The piping contractor who was responsible for the installation of the new air conditioning plant, was also present as a guest.

New Jersey Chapter Possible

One item entailing considerable discussion in the business meeting was the prospect of a New Jersey chapter. Formation of a chapter on the West side of the Hudson would eliminate considerable travel on the part of those members residing in that area. It is quite possible that the Jersey group will provide some friendly competition to their New York neighbors. If such a rivalry can get started similar to that carried on by New Orleans and Los Angeles, it should be beneficial to the membership and NAPRE on the whole, and it will provide an opportunity for the rival groups to pay visits to one another; other than at annual meetings, which is the best that the Californians and Dixie representatives can do at the present time.

Centrifugal Compressors Featured At First Fall Meeting

First regular Fall meeting of the New York NAPRE chapter got off to a good start September 11, with a meeting in the Winter Garden Room of the Sheraton McAlpin Hotel. Most of the old regulars were present and the committee's efforts at getting the word around were well rewarded. Many newcomers were present. Three new members were accepted and several application blanks were handed out.

The meeting opened with the temporary chairman giving a brief history of the Association, the concrete advantages of membership such as the text book "Basic Refrigeration", the magazine, INDSUTRIAL REFRIGERATION, the Operating Data Book, reprints and technical data from various manufacturers, and the intangible advantages of the lecture course based on the text book, *Basic Refrigeration*, participation in the Question Box, meeting with engineers engaged in the same line of work and the friendships and contacts to be made through membership in NAPRE.

The main feature of the meeting was an illustrated lecture on Centrifugal Compressors by Gus Contardi of the Carrier Corp. Contardi traced the history of centrifugals in this country back to 1922 when Dr. Willis Carrier brought the first machine from Germany. For several years no machines were manufactured here but were imported from Germany.

Contardi pointed out some of the advantages of this type of compressor; smaller space requirements in large tonnages, fewer working parts with less maintenance, adaptability to all types of drives such as various wound electric motors, steam turbine drives (even using exhaust steam at 2 to 5 psig), and internal combustion engines. Another point in favor of centrifugal compressors for use in high temperature or air conditioning work is that through the use of a relatively high boiling point refrigerant (Refrigerant-11 at 74 F) it is possible to open any portion of the system for maintenance without the necessity of pumping the system free of refrigerant.

Another interesting feature is the purger or scavenger built into the machine. This consists of a small compressor that continually pumps a small portion of gas from the top of the condenser. This gas is pumped through a condensing coil where the refrigerant is condensed and returned to the system. Non condensibles and water are pumped to a separate chamber where the non-condensibles are vented to atmosphere through a pre-set relief valve and water is removed through a drain valve. Contardi stressed that this is an important portion of the system since it is the means of keeping the system's refrigerant clean and only through clean refrigerant can maximum efficiency be attained. —QUAID MINICH.

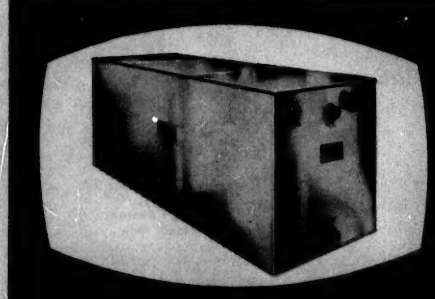
Green Bay Loses Bodart

GREEN BAY—Members of NAPRE in general and Green Bay Chapter in particular were saddened in September by announcement that the second president of the Green Bay Chapter had passed away. He died suddenly on September 17 of a heart attack.

Bert Bodart was a charter member of the Green Bay unit and had annually been re-appointed to the chapter educational committee.

Yeast Plant Tour

Opening meeting of the Fall season at Green Bay started with a field trip through the Charmin Paper Company at Green Bay. This company operates a yeast plant, which was of special interest to NAPRE members. Bert Van Camp, the lab chief of this plant, gave a very fine talk on the workings of this interesting process. Plant engineer Ashenbrenner assisted VanCamp in the conducted tour in such a manner as all were able to see the machines and equipment involved. For those not familiar with yeast plants it might be of interest to note that there is over 1000-tons of centrifugal refrigeration there.—JIM SCHOUTEN.



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Broken Pipe Releases Ammonia Gas

THREE persons were overcome by ammonia gas and about 125 had to flee two buildings when a refrigeration pipe broke while being repaired at the Luck Bros. Packing Co., Milwaukee, Wis. Aaron Luck, proprietor of the packing firm, said the gas leak probably occurred when workmen were repairing a compressor in the refrigeration plant. Luck said a piece of ice apparently fell on a valve and broke the connection. Luck said there was no damage, other than to the refrigeration equipment. All meat was in closed refrigerators.

Denver Ice & Storage Sold to New York Concern

OPERATING assets of Colorado Ice & Cold Storage Co., Denver, Colo., have been sold to Southeastern Public Service Co. of New York, according to Eugene H. Adams, secretary-treasurer of the Denver firm. Ownership is largely held by Adams and members of his family. A stockholders meeting approved the sale.

Colorado Ice has two plants in Denver, at 1700 W. Colfax Ave., and 2635 Blake St., and freezing facilities at Longmont. Non-operating assets including bonds, notes and land were retained. The company name will be used by the new owner and Colorado Ice stockholders met recently to select a new firm name.

Southeastern now operates about 50 similar plants throughout the United States. Management of the Denver plants will continue under Otis Roberts who has managed the firm for about one-and-a-half years under a contract between Colorado Ice and Southeastern.

Colorado Ice was founded in 1893 by Eugene and Clarence Adams' grandfather, Frank, who came to Denver from Gunnison, Colo.

COMING CONVENTIONS

NATIONAL ASSOCIATION OF ICE INDUSTRIES
November 12-15, 1957
Statler Hotel, Detroit, Mich.
Wm. T. Jobe, Exec. Vice-pres.

CANADIAN ASSOCIATION OF ICE INDUSTRIES
November 14, 1957
Statler Hotel, Detroit, Mich.
Mildred Croft, Exec-Secy.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS
November 14-16, 1957
Shoreland Hotel, Chicago
R. C. Crosz, Executive Secretary, New York City

NATIONAL ASSOCIATION
PRACTICAL REFRIGERATING ENGINEERS
November 18-21, 1957
Hotels Del Prado & Sherry, Chicago
J. R. Kelahan, Secretary

AIR CONDITIONING & REFRIGERATION EXPOSITION
November 18-21, 1957
International Amphitheatre, Chicago, Ill.
George Mills, Show Director

SOUTHWESTERN ICE MANUFACTURERS ASSOCIATION
December 1-3, 1957
Stephen F. Austin Hotel, Austin, Texas
P. A. Weatherred, General Counsel

DELTA STATES ICE ASSOCIATION
December 8-10, 1957
The New Montelone, New Orleans, La.
Edna Vaughan, Secretary.

Partial view of six Krack coolers installed by York Louisville Co.

KRACK
coolers end defrost problem
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for Merchants Wholesale Grocery Co., Louisville

✳ Electric defrost—Warm air from electric heaters is recycled within the unit.

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- RECIRCULATOR-TYPE CHILLERS
- SELF-MONITORING SOLENOID VALVES

For All Refrigerants

J. E. Watkins Co.

Thermostatic Control For Reefers

(Continued from Page 18)

Many questions remain to be answered. The characteristics of the thermoswitch best adapted to this use and its best location need further study. The possibility of undesirable warming, due to impedance of natural circulation by the baffles, during unscheduled delays needs further clarification. Although this aspect does not seem to be serious, the effect of the closed baffles when the car is standing at the packing shed before shipment and at its destination before unloading must be considered. The use of motors to operate the alternator under these conditions would, of course, overcome any problems due to an impeded circulation. The necessity of the baffles needs further study especially if control is applied only to the four corner fans.

Another question is, could this idea be put to use in connection with the heating of cars when there is freezing danger from low outside temperatures? The thermostat might turn on an electric resistance heater mounted in the fan-circulated air stream. Car heating is also sometimes desirable to obtain favorable intermediate temperatures.

Further testing of the performance of this equipment in cooperation with shippers and carriers, is anticipated.

Rotary Compressor

(Continued from Page 27)

extend through the rotor from bearing on a shaft in the center of the stator. The rotor meanwhile only acts as a drive for these blades and is an inner component part of the compression chamber. Since the rotor axis is offset to the blades axis (which is the same as the axis of the stator), turning of the interior assembly gives a reciprocating appearance between blade and rotor action. This would lead to by-passing of gas, except for this refinement: The rotor is perfectly sealed where it reciprocates on the main working blades. Two half moon shaped expanding seals form a round, bearing axis in the rotor when placed on each side of the blade. The added purpose of the rotary axis in the rotor is to take care of the lateral movement caused by the eccentric rotation of the rotor.

Blades and rotor rotate smoothly on their own axis without a reversal action of any of the mechanism. This is a departure from the principle of other rotaries where the blade has to reverse it's travel when the eccentric position of the rotor to the stator causes them to be pushed back in slots of the rotor.

Blackman's compressor has four compression chambers. That means it has four intake suction phases, and four compression phases, to give four equivalent reciprocating pump suction-compression-discharge cycles to one rotation. It has an open intake suction port without a valve and has one discharge valve for the compressed discharge. Both serve all four compression chambers.

Compression chambers open and close four ways. The rotor and stator open from each other, and the sealing blades open from each other, on suction phase. Naturally, they close on compression curve.

Proposed Commercial Size

Commercial types utilizing very little space so important to most operating enterprises, can be developed along the lines of the commercial experimental model outlined and constructed by the inventor. This model has an inside stator diameter of 16-5/8 in.; the outside diameter of the rotor is 15-7/8 in.; and the length of the compressor is 3 in. Displacement from one revolution of the compressor is 468 cubic inches or slightly better than a quarter cubic foot.

If the length were increased from 3 to 15 in., and assuming an 85 percent efficiency under standard ton conditions, a compressor would produce up to 200 tons of refrigerating effect while turning 728 rpm. Size of this compressor compared to that of any other of equal tonnage and rpm, it can be readily seen, is quite less than half the size of the others.

Other models for automobile air conditioning applications are pictured in Fig. 4. Displacement of one revolution of these compressors is 15 cu. in. Using "Freon-12", they would produce 3, 5, or 8-tons of refrigeration effect at 1200, 2000 and 3200 rpm, respectively.

Output of the Blackman compressor may be controlled by a pulley or a shaft coupling of another type mechanism also invented by Blackman, which enables the machine to produce a varying amount of refrigeration effect required in the plant. This pulley or coupling may be designed so as to provide either constant or variable speed and can be controlled automatically, electrically, or by pressure. Using this pulley in conjunction with one of the compressors shown in Drawing No. 4, an effective automobile air conditioning system could be produced; that is, a constant degree of coolness could be maintained in an automobile irrespective of motor speed and outside conditions.

Fig. 5 outlines the automatic constant speed pulley on motor crank shaft. This pulley will turn compressor and generator at 1200 to 1500 rpm allowing only a 300 rpm variation through entire range of motor speed. As motor speeds up to 1500 rpm, the water pump and fan will be operated through the pulley; at motor speeds above 1500 rpm they will automatically switch back to direct motor hook-up.

News of PEOPLE

Sanders Heads Institute Environmental Engineers

Henry F. Sander

FIRST president of the Institute of Environmental Engineers is Henry F. Sander, chief test engineer, Vapor Heating Corporation, Chicago, Ill. Sander, a member of the Society for Experimental Stress Analysis, Instrument Society of America and American Society for Quality Control, announced recently that the second annual technical meeting of the IEE will be held at the Hotel New Yorker, New York, April 17 and 18, 1958.

The purpose of IEE is to consider and act upon problems and questions relating to environmental engineering with a view to maintaining and improving the high standards of quality and service in the field of environmental testing. The organization also desires to collect and distribute accurate and reliable facts, data and statistics in order to inform their members of the activity and the information available in the industry, so that they may intelligently and scientifically conduct their efforts in a most up to date manner.

A subordinate group or section of IEE was recently established in Chicago. J. R. "Skip" Boyle of Boyle Engineering Laboratories was reported elected president of the Chicago section. Boyle is a member of the Chicago section of ASRE.

Terminal Refrigeration Honors Old Timer

THE management of Terminal Refrigerating Company, Los Angeles, recently took advantage of a special event to carry out a successful employee relations stunts. The special event was the retirement of a 72 year old employee who had been with the company since 1922. In addition to the usual farewell dinner and personal gifts, management recognized 35 years of loyal service by making this oldtimer "manager for a day".

He was told, "Anything goes". Pictures were taken with his feet on the "boss's" desk. He decided to take the company "brass" to lunch and buy them a drink. To avoid the company policy prohibiting drinking during working hours, the "new manager" fired the "brass" (Harlan Nissen and Buck Mills) during lunch so no one could claim they were company employees. After lunch he "rehired" the management team and the rest of the day went smoothly.

W. IRVING MOSS, JR., has been elected president of Midwest Cold Storage & Ice Corp., Kansas City, Mo.

CHARLES L. PRATT, National Ice & Cold Storage Co., Sacramento, Calif., recently was honored on the occasion of completion of fifty years of service. He received a diamond-encrusted pin from President Millard Young who himself received a 40-year pin.

AL VERSEN who is retiring as secretary of the Missouri Valley Chapter, NAPRE, was honored in recognition of his long and outstanding service to the Public Refrigerated Warehousing Industry, by NARW and the Chapter during a luncheon at the Missouri Athletic Club in St. Louis. He was presented a citation by an industry delegation consisting of W. Irving Moss, Jr., Kansas City, Kans.; Harry Spradling, Carthage, Mo.; and Herb Steinmeyer, Ewald Winterman and Eddie Neylon of St. Louis.

DEATHS

J. Richard Goodfellow

THE DEATH of J. Richard Goodfellow, 71, founder of the Olympic Warehouse & Cold Storage Co., Seattle, Wash., and member of a pioneer Seattle family, occurred September 29 in a hospital. He had been ill two months.

Mr. Goodfellow retired as president and general manager of the Olympic firm in July, 1956, ending 51 years in the warehouse and cold-storage business. He was on the advisory board of the cold storage division of the Office of Defense Transportation from 1941 to 1945. He was president of the Northwest Association of Refrigerated Warehouses from 1940 to 1947. He formerly was on the executive board of the National Association of Refrigerated Warehouses. He began his career with the old United Warehouse Co. and in 1930 founded the Olympic Warehouse & Cold Storage Co. He was a board member of the Washington State Pioneer Association and a member of the Seattle Historical Society, and the Seattle Rotary and Arctic Clubs.

B. F. THOMPSON who had been in the ice business in Landrum, S. C. for 27 years but was in semi-retirement since he suffered a stroke last February, died August 3. He was 81. His son, B. F. Thomson, Jr., is manager of The All Seasons Ice Company, Jacksonville, Fla.

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ICE CAN GRIDS

Industrial Trucks

and Trailers

THE OHIO GALVANIZING & MFG. CO.

FRICK

High-pressure Valves & Fittings

Large handwheel

Long oversized stem

Ample packing

One-piece collar box and bonnet

Back seat permits repacking in use

High-angle seat insures tightness

Standard flanges: screwed sizes to 2"

Full opening; developed for heavy duty

Are preferred for high-pressure services, 300 to 1500 lb., 300 degrees. Sizes ¼" thru 14". Stocked by Frick Distributors, the world over. Get new catalog with prices, weight, dimensions, working pressures, parts and useful tables.

Frick line includes fittings, safety valves, gauge glasses, return bends, manifolds and welded work.

WAYNESBORO, PENNA., U.S.A.

FRICK CO.

PIPE BENDING EXPERTS

Coils, Headers, Fabrications

Completely modern metalworking machines, plus over 37 years of "know-how", assure the finest work to your exact specifications. Proven specialists in custom bending in any form, any metal, even stainless steel.

May we quote on your next job?

CHICAGO NIPPLE MANUFACTURING CO.
1997 CLYBOURN · CHICAGO 14

complete refrigeration engineering service

Specialists in —

- Warehouses — Refrigeration and Insulation
- Food-Freezing
- Low Temperature Refrigeration
- Design of
  Non-Frost Heaving Floors
  Frost-Free Vestibules

Backed by a quarter-century of national and international experience, V. C. Patterson & Associates staff of specialized engineers is available to aid you with your refrigeration, insulation, food-freezing, warehousing, and allied problems. For new construction or for renovating present facilities, you'll find our engineered plans will mean greater efficiency and real money-saving operations. What's your problem? Write us.

V. C. PATTERSON & ASSOCIATES, INC.
415 West Market Street - York, Pa.
(Phone 82-058)

MANUFACTURERS' NEWS

Armstrong Cork Merges California Offices.

The Los Angeles and San Francisco offices of the Insulation Division, Armstrong Cork Company, are being merged to form the San Francsico-Los Angeles District Office, effective November 1, A. E. Pearce, General Sales Manager of the Division, has announced.

John S. Taylor, current District Manager of the San Francisco Office, has been named District Manager for the combined operation. Mann C. Sweet, of the Los Angeles Office, will serve as Branch Manager at Los Angeles under Taylor's direction.

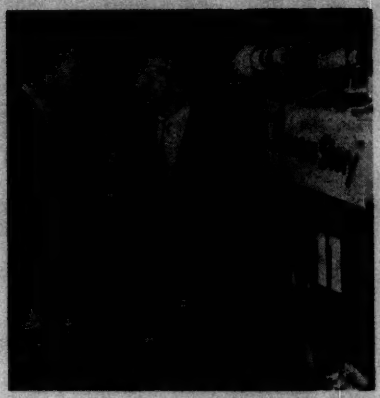
A. B. Callow, District Manager at Los Angeles, is retiring November 1 after more than 45 years service with the Company. He joined the Company in 1912 at Pittsburgh after attending Carnegie Institute of Technology. He has served as District Manager at Los Angeles since 1940. He has also served in district offices at Detroit, Atlanta, Denver and Kansas City.

Recold Corporation Honored On TV Show

THE RECOLD Corporation was honored recently by being featured on the Los Angeles award-winning television show, "Success Story". Spotlighting Recold's position as one of the pioneers in the industry, "Success Story" showed the entire story of the Company's operations, including engineering, drafting, assemblying, testing and research.

Films were made of the half-hour live show originating from Recold's headquarters at 7250 East Slauson in Los Angeles and will be shown at industry conventions, conferences and meetings during the next several months. The first showing is slated for ARI Show next November.

Executives of the Company who were interviewed on the show by Emcee Ken



Ernie Jarvis, secretary-treasurer of Recold being interviewed in television show.

Peters were: H. T. (Hy) Jarvis, President and founder of the firm; Dan Wile, Vice President and Chief Engineer; Ernie Jarvis, Secretary-Treasurer; Hal Jarvis, Advertising Manager.

Peters interviewed President Hy Jarvis in the Recold Museum of Air Conditioning and Refrigeration Equipment, where Mr. Jarvis explained and demonstrated the operations of several rare units such as the Whirlwind Fan, the Crosley Icyball Home Refrigerator and the Savage Mercury Refrigerating Machine.

Vice President Wile was interviewed during the introductory section of the show and explained the basic principles of refrigeration with "live" demonstrations, along with reviewing Recold's exclusive hot gas defrost system, Vapomatic.

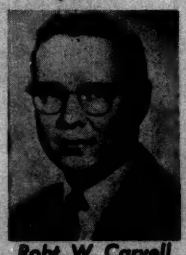
The Company's advertising manager, Hal Jarvis, accompanied Mr. Peters on a tour of the assembly line, pointing out various units in different stages of assembly.

It was also pointed out on "Success Story" that Recold was celebrating its 25th Anniversary during 1957, having been founded in 1932.

VAN RENSSELAER H. GREENE
ENGINEERS
COMPLETE PLANT DESIGNS INCLUDING BUILDING AND EQUIPMENT
11 PARK PLACE NEW YORK 7, N. Y.

Carvell Joins Henry Valve

IT HAS been announced by Charles V. Gary, general manager of the Henry Valve Company, Melrose Park, Illinois, that Robert W. Carvell has been added to their sales staff. As sales supervisor of their new "Industrial Division", Carvell is to head up Henry's newly expanded program on high pressure forged steel fittings and valves for industrial application.



Robt. W. Carvell

Until recently Carvell has been closely associated with the refrigeration and air conditioning industry, having been sales manager of the Bohn-Betz Division in Danville, Ill., concentrating on wholesaler activities. Prior to this he was with Kennard Corporation of St. Louis, Mo., as assistant sales manager. As a field engineer he sold automatic flow control devices for eight years with Alco Valve Company of St. Louis, in the Ohio, Michigan, Indiana, Pennsylvania, Kentucky and West Virginia area.

Carvell is a member of ASRE and attended Colorado School of Mines under the Army ASTP Program. He is a veteran of World War II, having served in the Pacific Theatre.

Recold Appoints Semple Works Manager

WILLIAM M. SEMPLE, well known as an outstanding executive of manufacturing operations, has been appointed works manager for the Recold Corporation of Los Angeles, H. T. (Hy) Jarvis, president of Recold, has announced. Recold's production has more than doubled in the last three years which has made necessary three different factory additions. To keep pace with this rather phenomenal growth Recold has created the new position of works manager.

Mr. Semple's experience qualifies him to handle Recold's rapid expansion program and to control operations of the 120,000 square foot Recold plant. He was formerly manufacturing director for Beckman Helipot Corporation of Newport Beach, California, manufacturers of precision electro-mechanical components and electronic systems. During his tenure of six years with Helipot, plant operations grew from one plant staffed by 200 employees to its present size of 1500 employees in four different plants.

Refrigeration Controls

A CONDENSED folder, describing controls adaptable for refrigeration-air conditioning use has been issued by the Partlow Corporation, New Hartford, N. Y. It describes recording, indicating, and non-indicating controls for precise, highly-sensitive control based on mercury expansion principle.

Anhydrous Ammonia Booklet

A NEW booklet on anhydrous ammonia has been issued by The Henry Bower Chemical Manufacturing Company, Philadelphia, Pa. It covers its industrial applications, describing the equipment, application and service involved in the distribution of anhydrous ammonia. Points covered include customer storage tank, cylinders, tank trucks, tank cars, physical and chemical properties, economics of anhydrous ammonia, first aid instructions and a saturated ammonia temperance table.

Technical Data Book on Anhydrous Ammonia

A NEW 68-page technical data book on anhydrous ammonia and ammonia liquor has been prepared for industry by Nitrogen Division, Allied Chemical & Dye Corp. The book fully describes anhydrous ammonia and ammonia liquor, listing their chemical and physical properties, specifications, handling and storage features, unloading methods, analytical procedures, and bibliography. Graphic illustrations include data pertaining to viscosities, density, vapor pressures, boiling and freezing points, and other characteristics.

Anhydrous ammonia and ammonia liquor are products of Nitrogen Division and are manufactured at three of the country's largest plants at Hopewell, Va., South Point, Ohio, and Omaha, Neb. These products have a wide diversity of uses in the chemical industry, such as in the manufacture of explosives, fertilizers, pulp and paper, textiles, synthetic resins, and rubber. They are also used widely in the metallurgical, petroleum refining and refrigeration industries.

Classified Advertising

All classified advertisements are payable in advance. Except for Positions and Help Wanted classifications, this section is reserved exclusively for USED equipment.

RATES: 20c per word; minimum 25 words, $2.00 per line for bold face headings; $15.00 per inch for line listings.

ICE PLANTS—wanted & for sale

FOR SALE—20 ton ice plant complete. Now in operation. For details write P.O. Box 555, Lonoke, Arkansas.

FOR SALE—40 ton ice plant, complete or individual items. Good condition; located Astoria, Oregon. Wilbur-Ellis Company, 320 California St., San Francisco 4, Calif.

USED EQUIPMENT—wanted & for sale

FOR SALE — Cheap. Ice plant equipment, with vertical compressors. Diesel and electric driven. Luckhardt Construction Co., 526 Flagler Ave., P.O. Box 1185, Stuart, Fla.

NAME PLATES—Engraved, plastic, weatherproof name plates for identification of valves and switches, control panels, etc. Black and white engraved characters. Send for price list and sample. Southern Name Plate, P.O. Box 1461, New Orleans 5, La.

WANTED TO BUY—a good used 30 ton ice plant. Write F. Videgaray, Postal Box 840, Monterrey, N.L. Mexico.

PERFORMANCE — If that's what you're looking for in your compressors, don't miss the Ball Valve ad on page 5 of this issue.

FOR SALE—6x5, 8x8 York compressors. 20" receiver. 4 ton ammonia ceiling hung blower unit. Valves up to 2", one-half price. Write E. Niebling, 1546 St. Clair Ave., Mt. Healthy, Cincinnati 31, Ohio.

FOR SALE—One Battle Creek Package Machine Company high speed wrapping machine. Model 51-S, with electric eye paper control, BiJur lubricating system, extra paper holder for quick change. 220 volts, 60 cycle, 3 phase. Machine purchased new direct from Battle Creek in September 1953; used only on short seasonal deals. Can be inspected at our plant. Mid-South Refrigerated Warehouse Company, 1100 East Parkway South, Memphis, Tenn. Phone FA 7-1611.

FOR SALE—AMMONIA

4—10"x10" 4-cyl. York duplex D. C. to 225 h.p. motor.
2—10"x10" 2-cyl. York D.C. to 100 h.p. motor.
1—9"x9" 2-cyl. York D. C. to 75 h.p. motor.
4—9"x9" 2 cyl. Frick compressors.
1—7¾"x8" Frick booster.
2—7½"x7½" 2-cyl. York compressors.
1—5¼"x4¼" 6cyl. V/W York booster compressor.
1—5"x5" 2-cyl. York compressor.
1—3"x3", 1—4"x4", 2—5"x5 condensing units.
11"x32"x47"—11"x32"x51 ice cans.
From 20 to 100 ton ice plants, York & Frick.
ENTERPRISE EQUIPMENT CORPORATION
79 Alexander St. Box 502 Yonkers, N. Y.
Cable "ENEQCO" Phone Yonkers 8-8118-9

USED EQUIPMENT—continued

FOR SALE

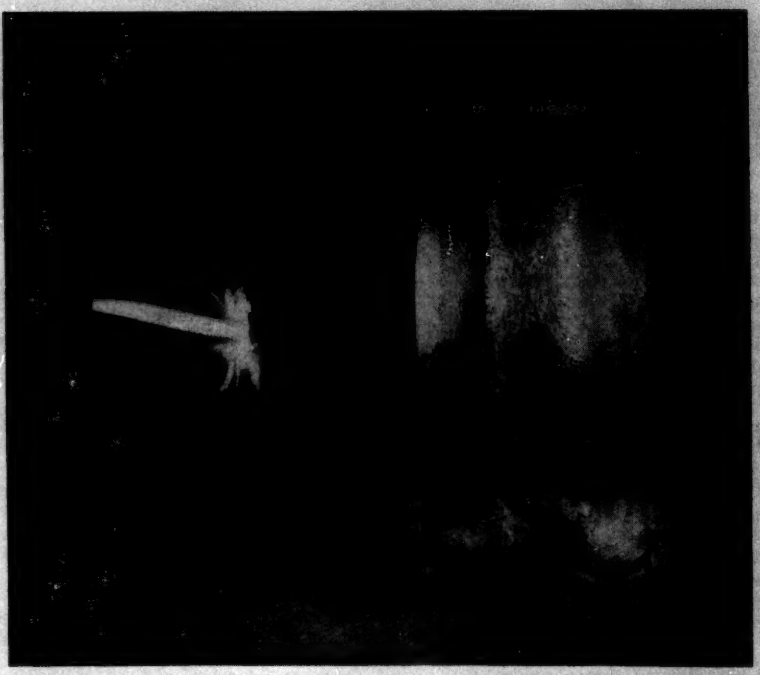
9x9 York duplex Model D8, 360 r.p.m.
8x8 Frick w/V-belt drive to 60 h.p. motor.
10x7½ & 8x6 York Model D8 boosters.
7½x7½ York w/V-belt drive to 50 h.p. motor.
5x5 & 4x4 York self-contained units.
300 h.p. Westinghouse starter 4160 volts (NEW)
Condensers, receivers, motors, etc.
100 h.p. 1200 r.p.m. G.E. motor w/starter.

JOHN F. CARSON
A & Venango Sts. Philadelphia 34, Pa.
GArfield 6-2221

FOR SALE — Refrigeration equipment; ice equipment; new, used. Advise us your needs. Use "QUICKSEAL" — stops brine tank leaks; easy, efficient, economical. Born Company, 80 East Jackson Boulevard, Chicago 4, Illinois. WAbash 2-8200

FOR SALE—One high speed 8x8 York ammonia compressor complete with 60 h.p. D. C. motor and V-belts. One high speed 5x5 York ammonia unit. Several 8x8 high speed York units. 40 square flanged York ammonia return bends on 6" centers. REAL BUYS. The Gus A. Regnier Refrigerating Engineering Co. P. O. Box 1093 New Haven, Conn.

FOR SALE—Three Carrier 30B4 Freon-12 chiller units; approximately 18 months in service. Two units equipped with 100 h.p. 440/3/60 motors, direct connected, nominally rated at 100 ton air conditioning. One unit equipped with 75 h.p., 440/3/60 motor, direct connected, possible capacity of 40 ton refrigeration at 0° F and 9.2# suction. All three units complete with gauge board and controls, including starters. Presently dismantled and ready for loading. Complete lot of equipment f.o.b. storage site at Green Bay, Wisc. $16,-200.00. Write or phone Gartner Refrigeration & Mfg. Inc., 2913 Lyndale Ave., South, Minneapolis 8, Minn. Phone TA 7-3553.



Why United's patented process results in corkboard of higher insulating value

Cork in its natural state is well known and highly regarded as an excellent insulating material. However, by an exclusive blocked-baked patented process that combines *both* external and internal heat in the moulding operation, United BB Corkboard is unsurpassed in insulating value.

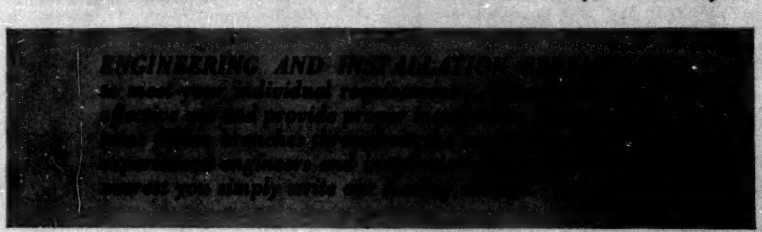
Further, United Corkboard is 100% cork . . . with no filler added, and, its high strength in relation to light weight permits a sturdy self-supporting structure that is simple to erect. It's flexible too . . . fits accurately, works as easily as lumber and the natural resins released during processing further add to its excellent moisture resistant characteristics.

The next time you have a need for low temperature insulation investigate the unique combination of benefits only "patented process" United Corkboard can provide.

Write today for specifications and helpful installation data. No obligation.

UNITED BB CORKBOARD

UNITED CORK COMPANIES
Since 1907
4 Central Avenue, Kearny, New Jersey



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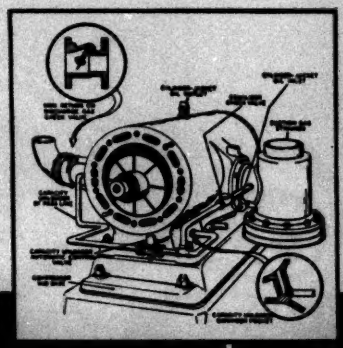
Front of tunnel showing packaging crew handling frozen peas from storage hopper at outlet of second stage freezing belt.

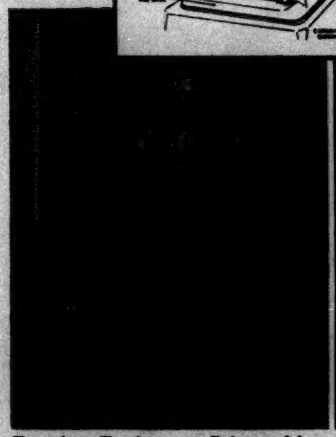
Side view of tunnel enclosure showing access doors to fan and coil compartments. Also shows a part of the refrigerant piping.

how to freeze 100,000 lbs. of peas a day

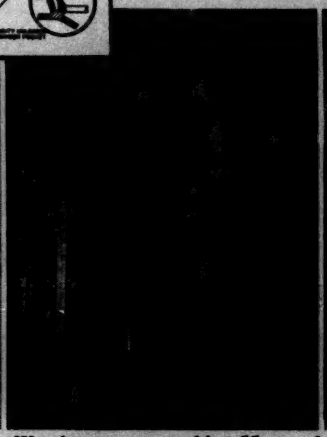
—AUTOMATION AND THE FES-FULLER ROTARY BOOSTER



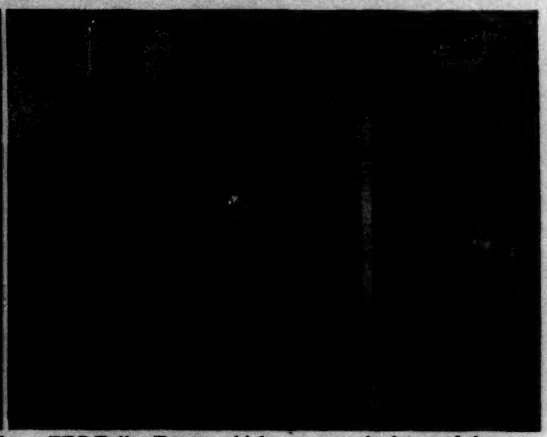
The Nittany Packing Company, Centre Hall, Pennsylvania has, through complete automation, processed more than 100,000 lbs. of peas in a single working day. From the moment the product leaves the picking table, the operation is entirely automatic until deposited in the loading hopper at the end of the freezing cycle. Maintaining the low and constant temperatures required for this belt tunnel is the job of the FES-Fuller Rotary booster.



Freezing Equipment Sales refrigerated flume used to transfer product to first stage. Also precools product to increase tunnel capacity.



Warehouse man stacking 55 pound cartons of frozen product. Product is stacked eighteen feet high. Storage designed to hold one week's production from tunnel.



FES-Fuller Rotary which serves as the heart of the refrigeration system.

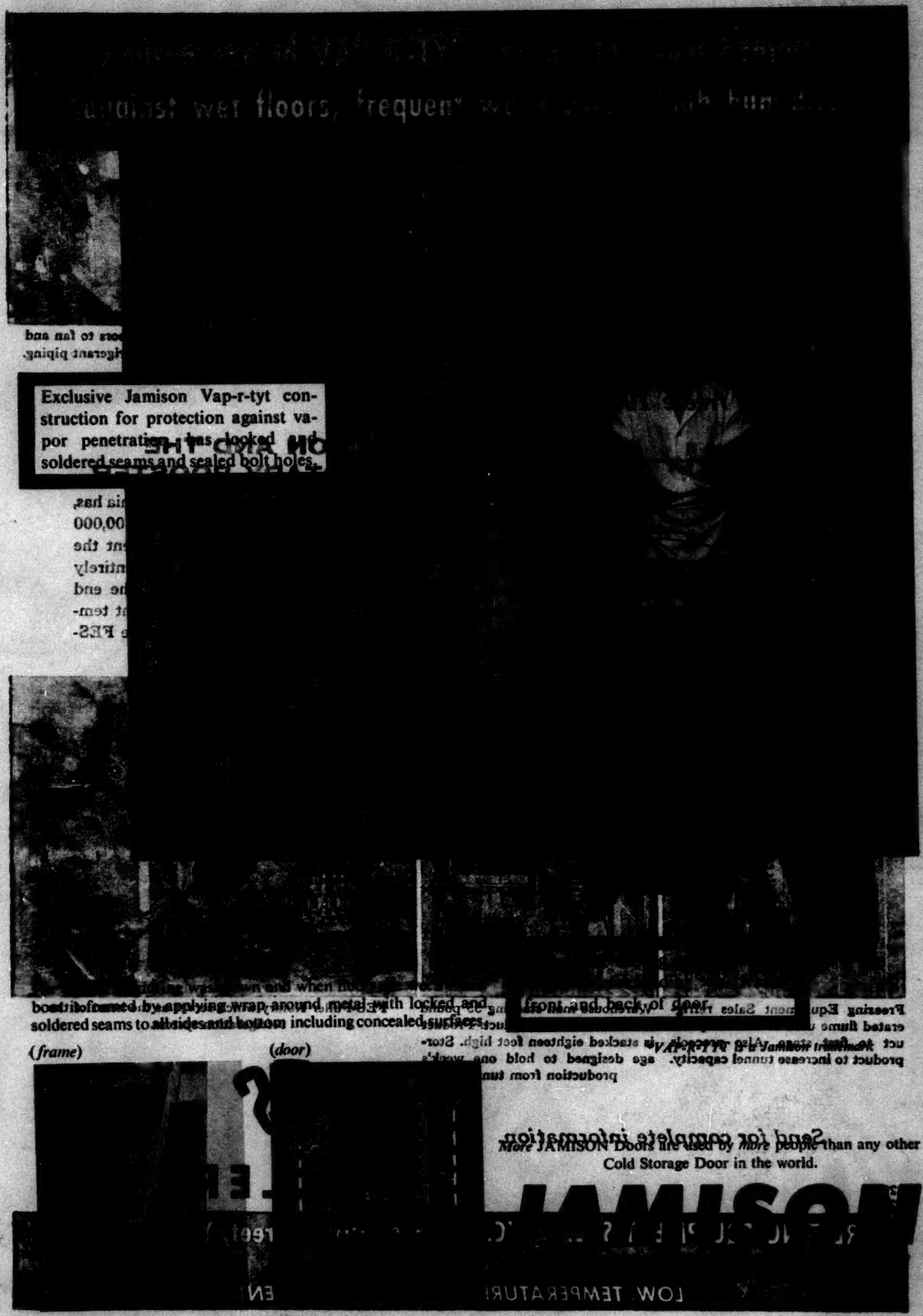
Send for complete information.

FES FULLER

3299
C292

FREEZING EQUIPMENT SALES, INC., 1405 N. DUKE Street, YORK, PENNA.

LOW TEMPERATURE FREEZING EQUIPMENT



Exclusive Jamison Vap-r-tyt construction for protection against vapor penetration, has locked and soldered seams and sealed bolt holes.

boot is formed by applying wrap around metal with locked and soldered seams to all sides and bottom including concealed surfaces.

(frame) *(door)*

More JAMISON Doors are used by *more* people than any other Cold Storage Door in the world.